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VIDEO ANALYZER

VP-8450A

SERVICE MANUAL

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SECTION I
GENERAL

1-1 INTRODUCTION

This instruction manual contains the following sections:

(1) Section I - General
Provides a general description of the analyzer.

(2) Section II - Specifications
Describes the specifications of the instrument.

(3) Section III - Adjustment
Explains in detail the adjustment procedures of the analyzer.

(4) Section IV - Operation
Explains in detail the operation procedures for each function of the analyzer.

(5) Section V - GP-IB overview
Describes the GP-IB standards.

(6) Section VI - GP-IB interface
Explains in detail the operation procedures related to the GP-IB interface.

(7) Section VII - External control interface
Explains in detail the function and operation procedure of the external control interface unique to this instrument.

1-2 DESCRIPTION

As shown in the configuration diagram in Figure 1-1, the VP-8450A Video Analyzer accepts composite video signals or Y / C separated signals and measures the luminance level, chrominance level, and chrominance phase at a desired point of the signal applied. It also measures the peak value of the signal.

To assure accuracy and speed in measurement, the analyzer has been so designed that the digital processing replaces the analog processing as much as possible. Measurement results are obtained by calculating the data produced by directly A / D converting the desired point of the input video signal.

Additional functions are: the preset memory function that can hold up to 32 sets of measuring conditions, the auto sequence function that automatically and sequentially recalls the preset memory data, and the function that outputs the measurement results to the printer. Also provided are the GP-IB and external control interfaces.

Having the features described above, the analyzer can be widely used as a measuring instrument for the designing, development, production, and inspection processing of mainly a video devices or a component of an automatic measurement system.

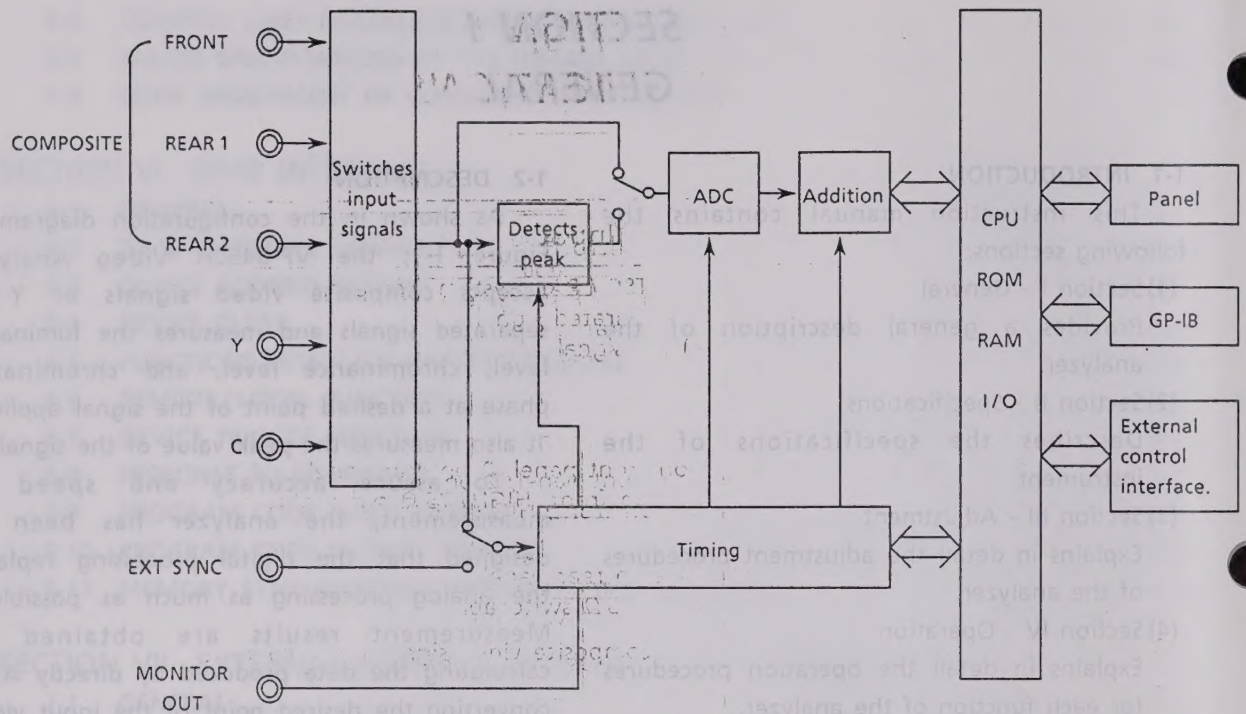


Figure 1-1 The configuration diagram of the VP-8450A

1-3 FEATURES

(1) NTSC/PAL systems in a unit

Covers most application in the designing, development, or production where both NTSC and PAL are handled.

(2) Accurate, high speed measurement

Uses a 10-bit A/D converter and a CPU for accurate and high-speed measurement.

(3) Peak measurement function

Besides the video level and phase measurement which are the main functions, the VP-8450A has the function for measuring the peak value of the video and alternating signals enabling a wider range of measurements.

(4) Y + S/C input

Also measurable are the Y + S/C separated signals which are widely used in video instruments for picture improvement.

(5) A large-size LCD for setup conditions and measurement results display

A large-size LCD has replaced the numeric indication system to display setup conditions and measurement results on a screen for easier reading and more effective operation.

(6) Monitor output with measuring point indicator

Connecting the analyzer's video output to a monitor television unit enables easy observation of the current measuring point and the measuring point after moving.

(7) 32 sets of the analyzer's setup memorable

The setup conditions required for measurement can be numbered from 0 to 31 for storing and can be recalled as desired. The setup conditions remain even if the power is turned off and can be regained as soon as the power is turned on again. Also the stored conditions can be recalled via the EXT CONTROL I/O connector on the analyzer's rear panel.

(8) GP-IB for automation

The GP-IB is provided as standard accessories for easy-interfacing with an external computer.

SECTION II
SPECIFICATIONS

Input	
Signals	(1) NTSC / PAL system composite video signal and Y / C separated signal (2) AC signal
Type	
(1) Composite video signal Number of inputs Input impedance	 1 on front panel, 2 on rear panel 75 Ω on front, HIGH / 75 Ω switchable on rear.
(2) Y / C separated signal Number of inputs Input impedance	 1 set on rear panel HIGH / 75 Ω switchable
(3) AC signal	Uses composite video signal input connector in (1) above.
(4) External sync signal Number of inputs Input impedance	 1 on rear panel HIGH / 75 Ω switchable

Measuring item	
Video level, phase measurement	
(1) Video level	Level measurement of horizontal sync, luminance, burst, and chrominance signals.
(2) Phase	Chrominance phase measurement
Peak measurement	
(1) Peak-Peak measurement	Measures peak-to-peak value of video and AC signals.
(2) + PEAK measurement	Measures + peak-to-peak value from a desired sampling point.
(3) – PEAK measurement	Measures – peak-to-peak value from a desired sampling point.

Measuring range		
Maximum input level		1.6 Vp-p
Input range	(mV)	1.6 V, 1.3 V, 1.14 V, 1.0 V, 0.89 V, 0.8 V, 0.73 V, 0.67 V, 0.62 V, 0.57 V
	(IRE / NTSC)	224.0 IRE, 182.0 IRE, 159.6 IRE, 140.0 IRE, 124.6 IRE, 112.0 IRE, 102.2 IRE, 93.8 IRE, 86.8 IRE, 79.8 IRE
	(IRE / PAL)	160.0 IRE, 130.0 IRE, 114.0 IRE, 100.0 IRE, 89.0 IRE, 80.0 IRE, 73.0 IRE, 67.0 IRE, 62.0 IRE, 57.0 IRE
		These ten ranges can be switched by panel operation.

Measuring accuracy	
Video level, phase measurement	
(1) Video level	Within ± 1 % of full scale.
(2) Phase	Within ± 1 degree.
Peak measurement	
(1) Video signal	
Accuracy	± 5 % of full scale for step signal.
Frequency response	Within ± 5 % of full scale at 5.8 MHz with reference to packet frequency 0.5 MHz.
(2) AC signal	
Accuracy	± 5 % of full scale at 0.1 MHz
Frequency response	Within ± 5 % of full scale at 5 MHz with reference to 0.1MHz.

Video polarity, offset	
Video polarity	Switches polarity with panel switch as required for sync negative and video positive signal or sync positive and video negative signal.
Video offset	Variable in 4 mV step between 0 to 1.0 V where input range is 1 V.

Synchronization (for video signal)	
Sync type	(1) Sync signal in composite video or Y / C separated signal. (2) External sync signal.
Sync signal level range	0.15 to 0.6 Vp-p
Color burst	
(1) Level range	0.15 to 0.6 Vp-p
(2) Frequency range	3.579545 MHz ± 150 Hz (NTSC) 4.43361875 MHz ± 150 Hz (PAL)
Sync polarity	Switches polarity with panel switch as required for sync negative or sync positive signal. As for external sync signal, polarity must be the same as that of video signal.

Measuring point	
Video level, phase measurement	
(1) Acceptable resolution Horizontal (H) Vertical (V)	 0.1 μs / step 1 line / step
(2) Minimum setting interval	1 μs
(3) Horizontal (H) Maximum number of points	64 points (including sync and burst)
(4) Vertical (V) Maximum number of lines	32 lines
(5) Total number of points	256 points max.
Peak measurement	
(1) Video signal	Resetting and sampling points are the same for video level and phase measurement.
(2) AC signal	Resetting and sampling time 100 μs.

Summation average	
Number of times	2, 4, 8, 16, 32, 64
Type	Consecutive lines, field, 1 frame, 2 frames

Output	
Video signal	
(1) Signal content	Composite video signal to which a marker (white level) indicating measuring point is inserted (Outputs added signal for Y / C separated signal input)
(2) Level	1 Vp-p approx.
(3) Impedance	75 Ω
Peak signal	
(1) Signal content	Analog peak detection signal in peak measurement.
(2) Input / output ratio	1 : 1 approx.
(3) Impedance	470 Ω
Reset signal	
(1) Signal content	Timing signal indicating starting point of peak measurement.
(2) Level	TTL

Output (Cont'd)	
Sample signal	
(1) Signal content	Timing signal indicating sampling point in peak measurement.
(2) Level	TTL
S/H (Sample and Hold) signal	
(1) Signal content	Timing signal indicating reference sampling point in + PEAK and – PEAK measurements in Peak measurement.
(2) Level	TTL

Preset function	
Number of memory registers	32
Data to be stored in a register	(1) Selected system : NTSC or PAL (2) Input connectors and their impedance (3) Polarity of input signal (4) Internal / external sync and their impedance (5) Selected measurement period (field / frame / 2 frames) (6) Input range (7) Off set (8) Number of times of averaging (9) Measuring position (10) Data of EXT CONTROL I/O port output P1 and P2

Remote control	
Type	GP-IB, EXT CONTROL I/O
GP-IB	SH1, AH1, T7, L3, SR1, RL1, PP0, DC1, DT1, C0 · Memory data copy function in talk only and listen only modes. · Memory recall operation associated movement function in talk only and listen only modes.
EXT CONTROL I/O	(1) Sequential recall operation of memory. (2) Direct recall operation of memory. (3) External control output (8 bits × 2 ports) (4) Reading external data (8 bits × 1 port) (5) Printing out of preset memory content and measured values. (6) Remote control of rotary encoder.

Others	
Temperature and humidity	
(1) For assured operation	5 to 35 °C, less than RH 85 %
(2) For operation	0 to 40 °C, less than RH 90 %
(3) For storage	– 20 to 70 °C, less than RH 90 %
Power supply	100 - 120 V, 230 V nominal, switch selectable, 90 VA max.
Dimensions	426 (W) × 99 (H) × 450 (D) (mm)
Mass	9 kg approx.
Accessories	Power cable ..... 1 Spare fuse ..... 1 Instruction manual 1

SECTION III
ADJUSTMENT

3-1 PREPARATION

(1) Fig. 3-1 shows the name and configuration of the boards.

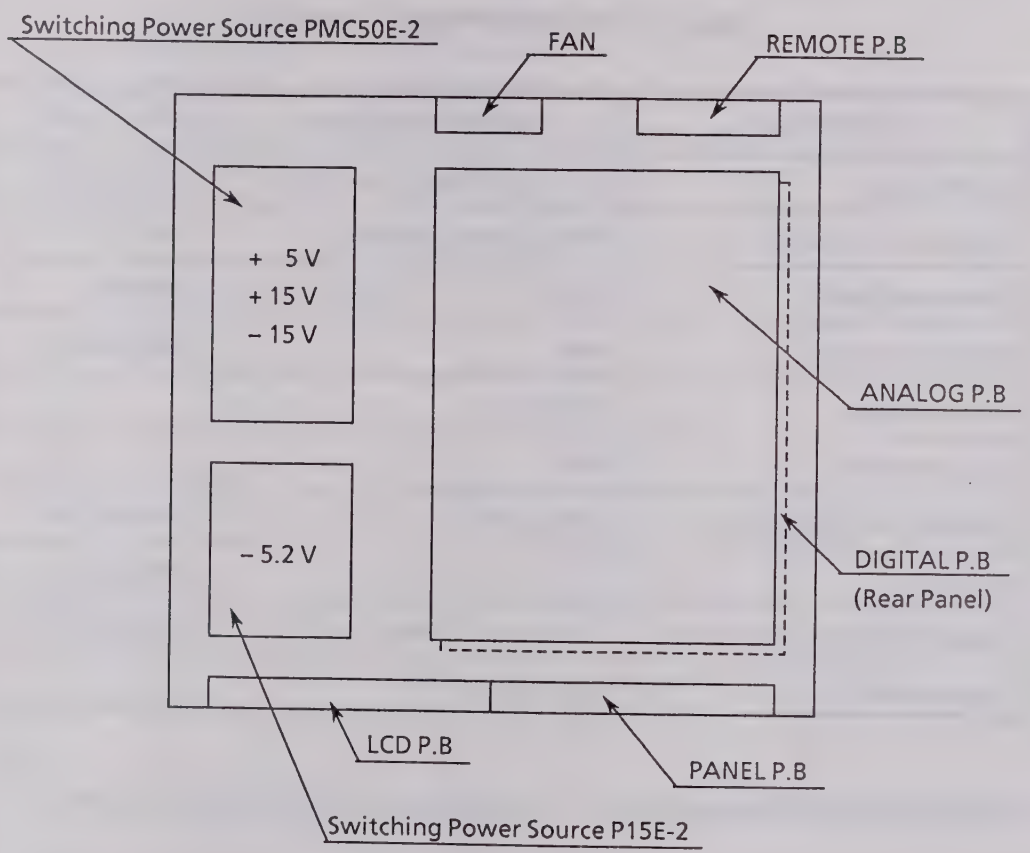


Fig. 3-1 BOARDS CONFIGURATION

(2) Check that a right fuse is installed and No mis-connections.
(3) Set all trimmer capacitors and variable resistors at a center position of a turning range. Do not turn variable resistors of the power source and multi-turns variable resistors.
(4) Put on a Power. Except otherwise stated, the function checks and confirmations are performed in the condition of the main power source at 100 V ± 2%, 50/60 Hz.
(5) Function checks and adjustment works should be started after 30 minutes from the power on.
(6) Test equipments should be calibrated and used the one listed in Table 1 or their equivalents.

Table 3-1 TEST EQUIPMENTS AND JIGS

EQUIPMENT	SPECIFICATION	TYPE
Oscilloscope	DC to 200 MHz, 5 mV/Div	VP-5520B
Frequency counter	Microwave counter	TR5212
Video analyzer	NTSC	VM700
Video analyzer	PAL	VM700A
Color monitor	NTSC	
Color monitor	PAL	
Video signal generator	NTSC, PAL	VP-8400A
D.V.M.		VP-2661B
Standard signal generator	10 Hz to 20 MHz Z = 75Ω	hp 3336C
Termination	75Ω BNC	

- Test equipments should be equivalent or the one furnished with more accuracy.

3-2 ADJUSTMENT AND CHECK OF A POWER SUPPLY

(1) Connect D.V.M. to TP19 of analog P.C.B.

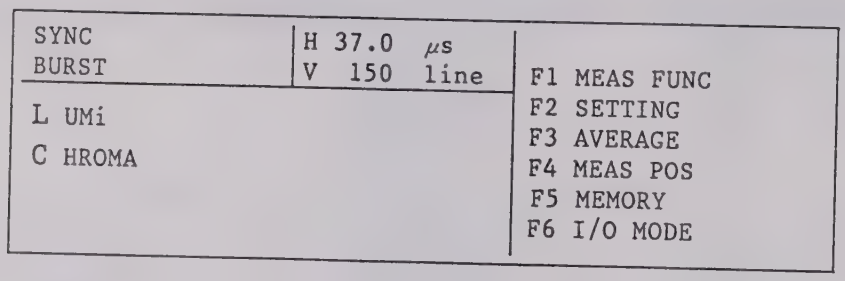
(2) Adjust VR61 of the Switching Power Supply (P15E-2) so as a voltage to be – 5.2 V ± 100 mV.

(3) Confirm D.C voltages in connecting D.V.M. to each test point;

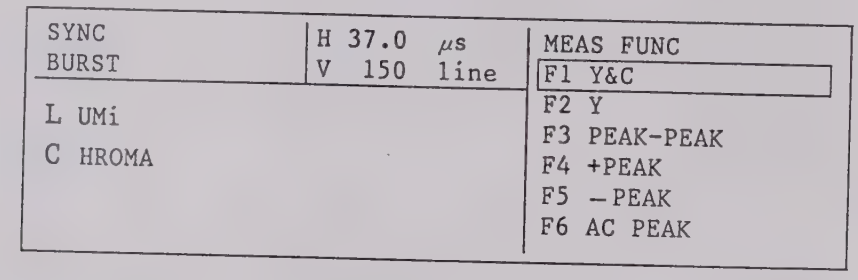
TP14	.....	+ 5 V ± 200 mV
TP16	.....	+ 15 V ± 200 mV
TP17	.....	– 15 V ± 200 mV
TP15	.....	+ 12 V ± 500 mV
TP18	.....	– 12 V ± 500 mV
TP21	.....	+ 5 V ± 200 mV
TP22	.....	– 5 V ± 200 mV
TP20	.....	+ 12 V ± 500 mV

3-3 SETTING OF THE FRONT PANEL

(1) When the power is on, on the L.C.D. a following display appears.

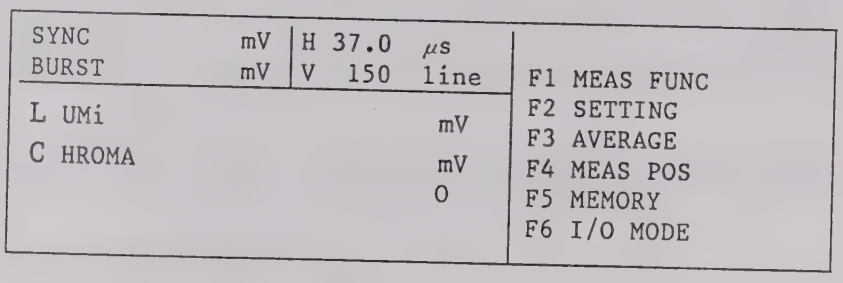


(2) Select "MEAS FUNC" and press F1 KEY then the L.C.D. changes as follows;

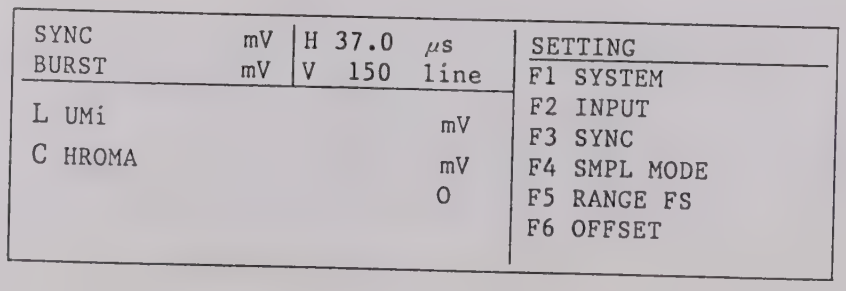


The previously selected FUNCTION is invertedly displayed.
When the power is on, "Y&C" is displayed in reverse video.

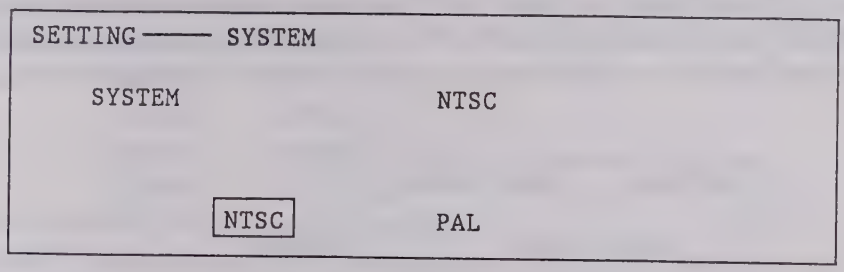
(3) Select "Y&C" and press F1 KEY The L.C.D. changes as follows;



(4) Select "SETTING" and press F2 KEY. The L.C.D. changes as follows;

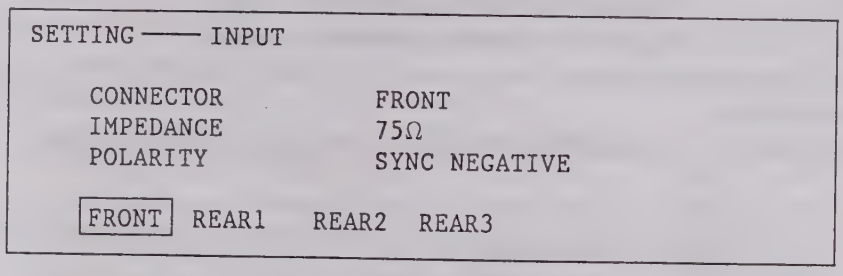


(5) Select "SYSTEM" and press F1 KEY. The L.C.D. changes as follows;



When the power is on, "NTSC" is displayed in reverse video. Turn the JOG & SHATTLE on the panel to right (either an outer shattle ring or an inner jog dial) and confirm the display in reverese video to be "PAL". Then select "NTSC" and press "EXIT" KEY. The L.C.D. display return to (4) display.

(6) Select "INPUT" and press F2 KEY. The L.C.D. display changes as follows;

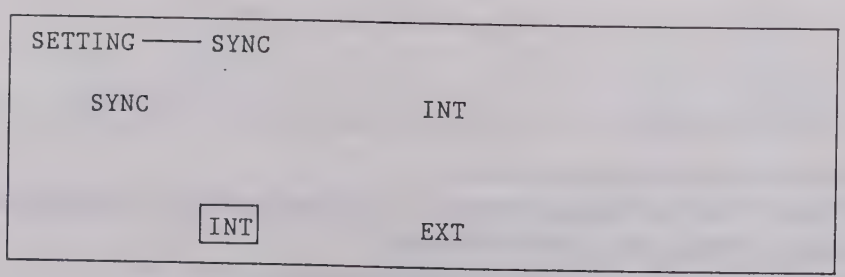


① When the power is on, "FRONT" is selected and displayed in reverse video. As the JOG and SHATTLE is turning to right, the display in reverse video changes to "REAR 1", "REAR 2" and "REAR 3" successively. Now select "FRONT".

② Press "NEXT" KEY. The display "FRONT", "REAR 1", "REAR 2", and "REAR 3" under the lowest column of the L.C.D. display disappear and the display in reverse video shifts to "75Ω". When "FRONT" is selected on CONNECTOR, there is no choice other than "75Ω" for an impedance, but if "REAR 1", or "REAR 2" or "REAR 3" is selected, 75Ω and Hi-Z are displayed on the lowest column on the L.C.D. and select one of them by JOG & SHATTLE.

③ Press again "NEXT" KEY. The display in reverse video shifts to "SYNC NEGATIVE" and on the lowest, "SYNC NEGATIVE" and "SYNC POSITIVE" are displayed. Select one according to the SYNC polarity of the signal. Usually "SYNC NEGATIVE" is selected. Press "EXIT" KEY then the L.C.D. display returns to the (4)'s.

(7) Select "SYNC" and press F3 EKY. The L.C.D. display changes as follows;



① A previously selected one is displayed in reverse video. By JOG & SHATTLE select "EXT", then under the SYNC, IMPEDANCE is displayed.

② Select 75Ω of IMPEDANCE by "NEXT" KEY, the lowest display changes to 75 Ω and Hi-Z. Press again "NEXT" KEY, set to SYNC INT. Press "EXIT" KEY then the L.C.D. display changes as follows;

(8) Select "SMPL MODE" and press F4 KEY. The L.C.D. display changes as follows;

```
SETTING ——— SMPL MODE

    SAMPLE MODE              2FILEDS


    1FILED    [2FILEDS]      4FILEDS
```

① 1 FIELD ..... In case of the measurement in every field
2 FIELDS ..... In case of the one measurement in 2 fields
4 FIELDS ..... In case of the one measurement in 4 fields

② Select by the observing signal. Now select "2 FIELDS". Press "EXIT" KEY then the L.C.D. display returns to the (4)'s.

(9) Select "RANGE FS" and press F5 KEY then the L.C.D. display changes as follows;

```
SETTING ——— RANGE FS

    RANGE FULL SCALE      1000mV


570mV  620mV   670mV   730mV   800mV
890mV [1000mV] 1140mV  1300mV  1600mV
```

Select by the input signal level. Usually for the 75 Ω terminated 1 Vp-p signal, select "1000 mV". Press "EXIT" KEY. Then the L.C.D. display returns to the (4)'s.

(10) Select "OFF SET" and press F6 KEY then the L.C.D. display changes as follows;

```
SETTING ——— OFFSET

    OFFSET                0mV
```

Select when the input signal has an offset.

① On 4 mV step, the offset changes – 280 mV to + 720 mV in NTSC and – 300 mV to + 700 mV in PAL.

② In the standard video signal, select 0 mV OFFSET.

Press "EXIT" KEY then the L.C.D. display returns to the (4)'s.

Enter into adjustment courses when an operation is well understood.

3-4 VIDEO MODE ADJUSTMENT

Connect a COMPOSITE output of 8400A to the input terminal on the front panel.

(1) GEN LOCK ADJUSTMENT

① PANEL SETTING (Refer 3 PANEL SETTING)

MEAS FUNC	Y&C	
SETTING	SYSTEM	NTSC
	INPUT	FRONT
	POLARITY	NEGATIVE

② Set SYSTEM of VP-8400A to NTSC of any output signal.

③ Connect a probe of an oscilloscope to TP23 and adjust a trimmer capacitor C265 so as the voltage at TP23 to be about + 5 V.

④ Set SYSTEM of VP-8450A to PAL and also SYSTEM of VP-8400A to PAL. Adjust a trimmer capacitor C264 so as the voltage at TP23 to be about + 5 V.

(2) 10 MHz OSC ADJUSTMENT

① Connect a frequency counter to TP1 through the oscilloscope's probe.

② On the panel, set MEAS FUNC to AC PEAK (Function key F6).

③ Adjust a trimmer capacitor C263 so as an oscillation frequency to be in 10 MHz ± 5 kHz.

(3) A/D REFERENCE VOLTAGE ADJUSTMENT

① On the panel, set MEAS FUNC to Y&C and SYSTEM to NTSC.

② Set an output signal of VP-8400A to PAL EBU COLOR BARS signal.

③ Connect D.V.M. to TP2 and adjust R308 so as the D.C voltage to be + 2.048 V ± 1 mV.

④ Connect D.V.M. to TP3 and adjust R184 so as the D.C voltage to be + 1.024 V ± 1 mV.

⑤ Connect D.V.M. to TP5 and adjust R309 so as the D.C voltage to be – 2.048 V ± 1 mV.

⑥ Connect D.V.M. to TP4 and adjust R310 so as the D.C voltage to be – 1.024 V ± 1 mV.

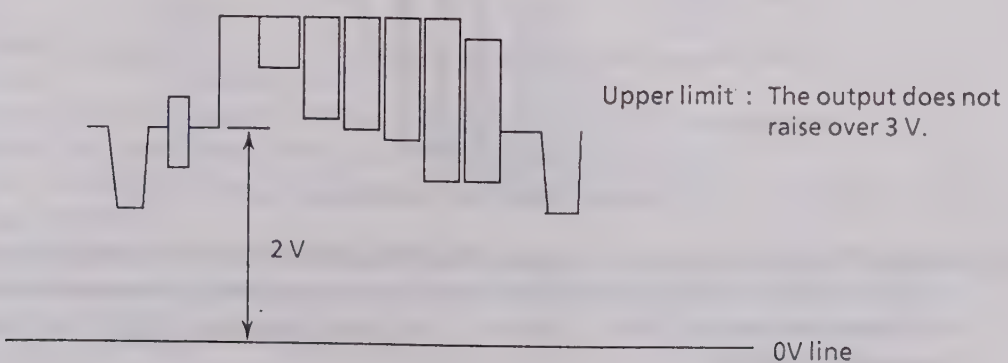
⑦ Check again voltages of each TP2, TP3, TP5 and TP4 to be on the specified values.

(4) OFFSET ADJUSTMENT

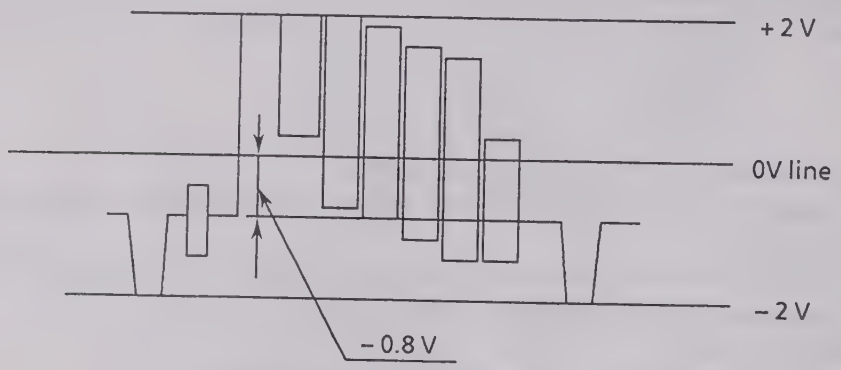
① Connect an oscilloscope to TP7.

② On the panel, Set SETTING to OFFSET. (Refer 3-(10) OFFSET SETTING)

③ Set OFFSET to 700 mV by JOG dial or SHATTLE ring and adjust R305 so as the pedestal level of TP7 signal to be about + 2 V.



④ On the panel, set OFFSET to 0 mV and adjust R307 so as the pedestal level of TP7 signal to be about − 0.8 V.



(5) FRONT INPUT LEVEL ADJUSTMENT

① PANEL SETTING

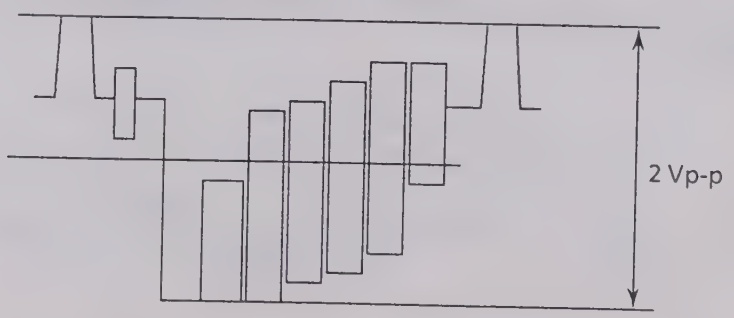
RANGE 1000 mV
OFFSET 0 mV

② Before level adjustment, obtain by VM700A the COMPOSITE output signal level. (PAL EBU COLOR BARS)

- On H-Timing of VM700A , Level of SYNC BURST
- On COLOR BAR of VM700A, Level of WHITE LUMINANCE
  Level of GREEN CHROMINANCE

③ Connect the output of VP-8400A to the input terminal on the panel and supply an already checked COMPOSITE signal from VP-8400A and press REPEAT KEY on the panel.

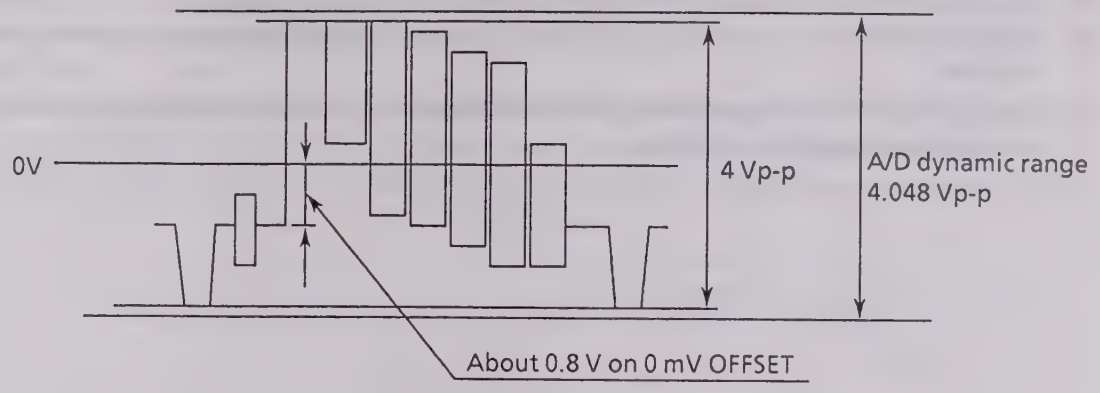
④ Connect an oscilloscope to TP11 and adjust R295 so as the signal level to be 2 Vp-p.



⑤ Set a H POSITION on the L.C.D. display of the front panel to the white part of the input signal (H = 12.5 μS) and adjust R303 so as the LUMI level to be an equal level to the measured value by VM700A (In a measured value ± 2 mV). Confirm in the same time that SYNC level is also a same level measured by VM700A.

Note: In changing the OFFSET of the panel setting, check measured values of the luminance level of the white part and of the SYNC level are not altered.
For example, on the luminance level of the white part, the measured value on the 0 mV OFFSET to be same to that in changing OFFSET from + 4 mV to − 12 mV. And for the SYNC level, the measured value on the 0 mV OFFSET to be same to that in changing OFFSET from − 4 mV to + 12 mV. That is to confirm the present status does not overscale the dynamic range of A/D.
If it is not so, adjust R307 so as the signal to be in the dynamic range.

- Connect an oscilloscope to TP7.



- Adjust R307 so as the signal not to be over the A/D's dynamic range.

⑥ Set a H POSITION on the panel to the green part (H = 32.5 μs) and adjust a trimmer capacitor C258 so as CHROMA level to be the same as the measured value by VM700A (in the measured value ± 2 mV) and a same time confirm the BURST level also is same as the measured by VM700A.

(6) REAR 1 INPUT LEVEL ADJUSTMENT

① PANEL SETTING

INPUT	REAR 1
IMPEADANCE	75 Ω
POLARITY	SYNC NEGATIVE

② Connect the COMPOSITE output of VP-8400A to INPUT VIDEO 1 of the rear panel.

③ Press REPEAT KEY on the front panel and set H POSITION to H = 12.5 μs.

④ Check the L.C.D. display on the panel and adjust R291 so as the level to be same as the measured by VM700A.

⑤ Set H POSITION to 32. 5 μs and adjust a trimmer capacitor C259 so as the green CHROMA level to be same as the measured by VM700A.

(7) REAR 2 INPUT LEVEL ADJUSTMENT

① PANEL SETTING

INPUT	REAR 2
IMPEADANCE	75 Ω
POLARITY	SYNC NEGATIVE

② Connect the COMPOSITE output of 8400A to the INPUT VIDEO 2 of the rear panel.

③ Press REPEAT KEY on the front panel and set H POSITION to H = 12.5 μs.

④ Check the LUMI level on the L.C.D. display and adjust R292 so as the level to be same as the measured by VM700A.

⑤ Set H POSITION to 32. 5 μs and adjust a trimmer capacitor C260 so as the green CHROMA level to be same as the measured by VM700A.

(8) REAR Y/C INPUT LEVEL ADJUSTMENT

① PANEL SETTING

INPUT	REAR Y/C
IMPEADANCE	75 Ω
POLARITY	SYNC NEGATIVE

② Connect the COMPOSITE output of VP-8400A to the INPUT C of the rear panel.

③ Press REPEAT KEY on the front panel and set H POSITION to H = 12.5 μs.

④ Check LUMI level on the L.C.D. and adjust R293 so as the level to be same as the measured by VM700A.

⑤ Set H POSITION to 32. 5 μs and adjust a trimmer capacitor C261 so as the green CHROMA level to be same as the measured by VM700A.
⑥ Connect COMPOSITE output of VP-8400A to INPUT Y on the rear panel.
⑦ Set H POSITION to 12. 5 μs and adjust R294 so as the white LUMI level to be same as the measured by VM700A.
⑧ Set H POSITION to 32. 5 μs and adjust a trimmer capacitor C262 so as the green CHROMA level to be same as the measured by VM700A.

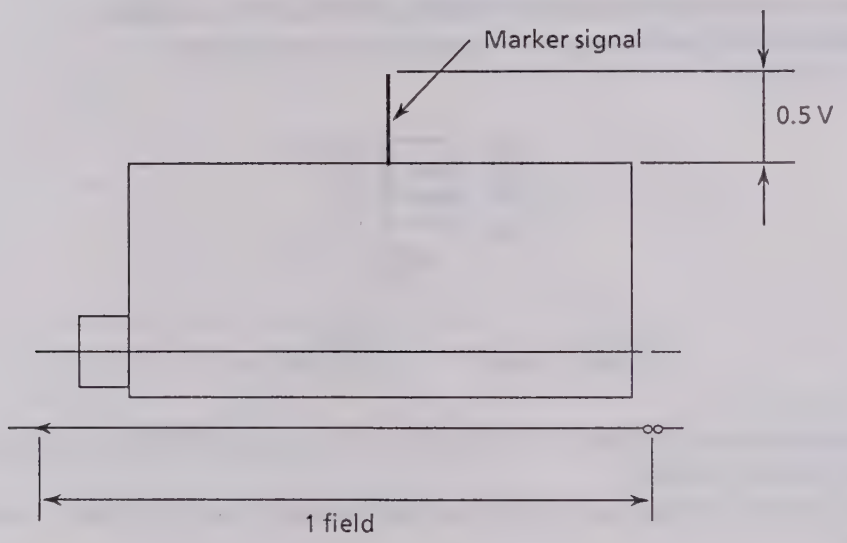
3-5 MARKER LEVEL ADJUSTMENT

(1) PANEL SETTING

INPUT	FRONT
POLARITY	SYNC NEGATIVE
SYSTEM	PAL

(2) Connect the COMPOSITE output (PAL EBU COLOR BARS) of VP-8400A to INPUT on the front panel.

(3) Connect OUTPUT terminal VIDEO on the rear panel to an oscilloscope (75 Ω termination).
Connect the drive signal VD of VP-8400A to EXT TRIG (CH3) of the oscilloscope and let VD as TRIG.



- Adjust R302 so as the VIDEO signal added marker to be about 0.5 V.
- Before enter the next PEAK MODE adjustment turn out R53 to the clock wise full.

3-6 PEAK MODE ADJUSTMENT

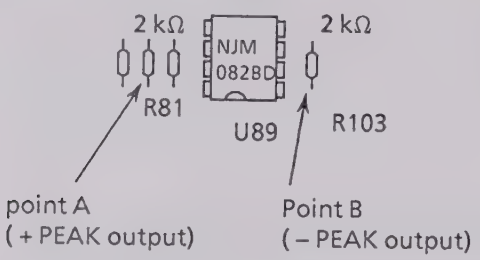
(1) + PEAK ADJUSTMENT (VP-8400A 5 STEP BURST 0%)

① PANEL SETTING

MEAS FUNC	+ PEAK	
SYSTEM	PAL	
INPUT	FRONT	
POLARITY	SYNC NEGATIVE	
MEAS POS	RESET	H = 12 μs
		V = 150 lines

② Connect the COMPOSITE signal of VP-8400A to INPUT on the front panel.

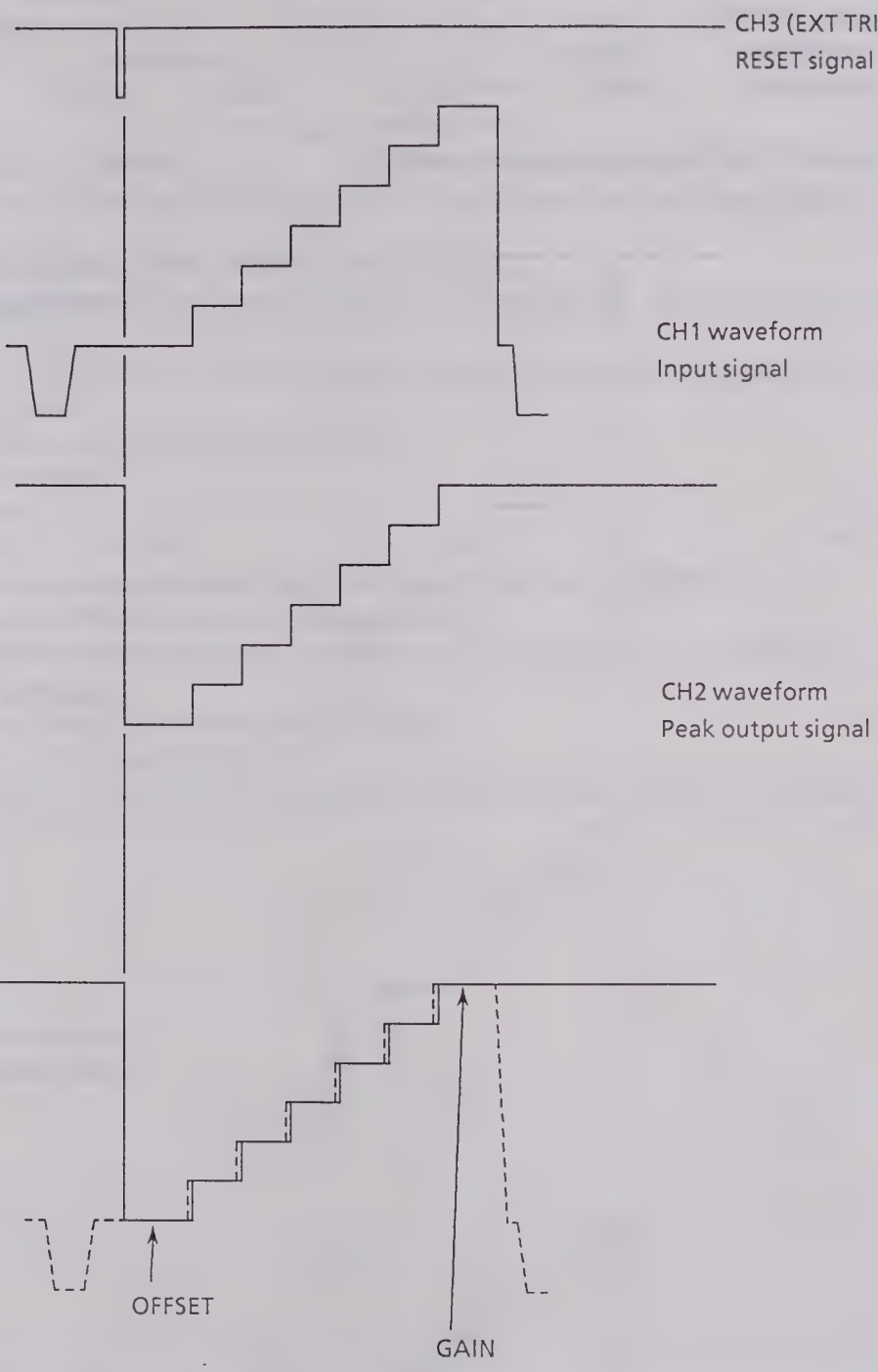
③ Connect CH1 of the oscilloscope to TP10 and CH2 to the point A.



④ Connect OUTPUT terminal RESET (TTL signal) on the rear panel to EXT TRIG (CH3) of the oscilloscope and let it as TRIG. (SLOPE -)

⑤ Set the sensitivity of CH1 and CH2 of the oscilloscope to both 0.5 V/div. (on KNOB indication 50 mV/div)

⑥ Set AC, DC change switch of both CH1 and CH2 to GDN and in adjusting a vertical position of CH1 and CH2, superpose both trace on the screen then set the both switch to D.C.



- Adjust GAIN ADJ R300 for the luminance top part of the superposed waveforms and OFFSET ADJ R298 for their sink tip part to get an entire superposition.

(2) – PEAK ADJUSTMENT (VP-8400A EBU CHROMA 0%)

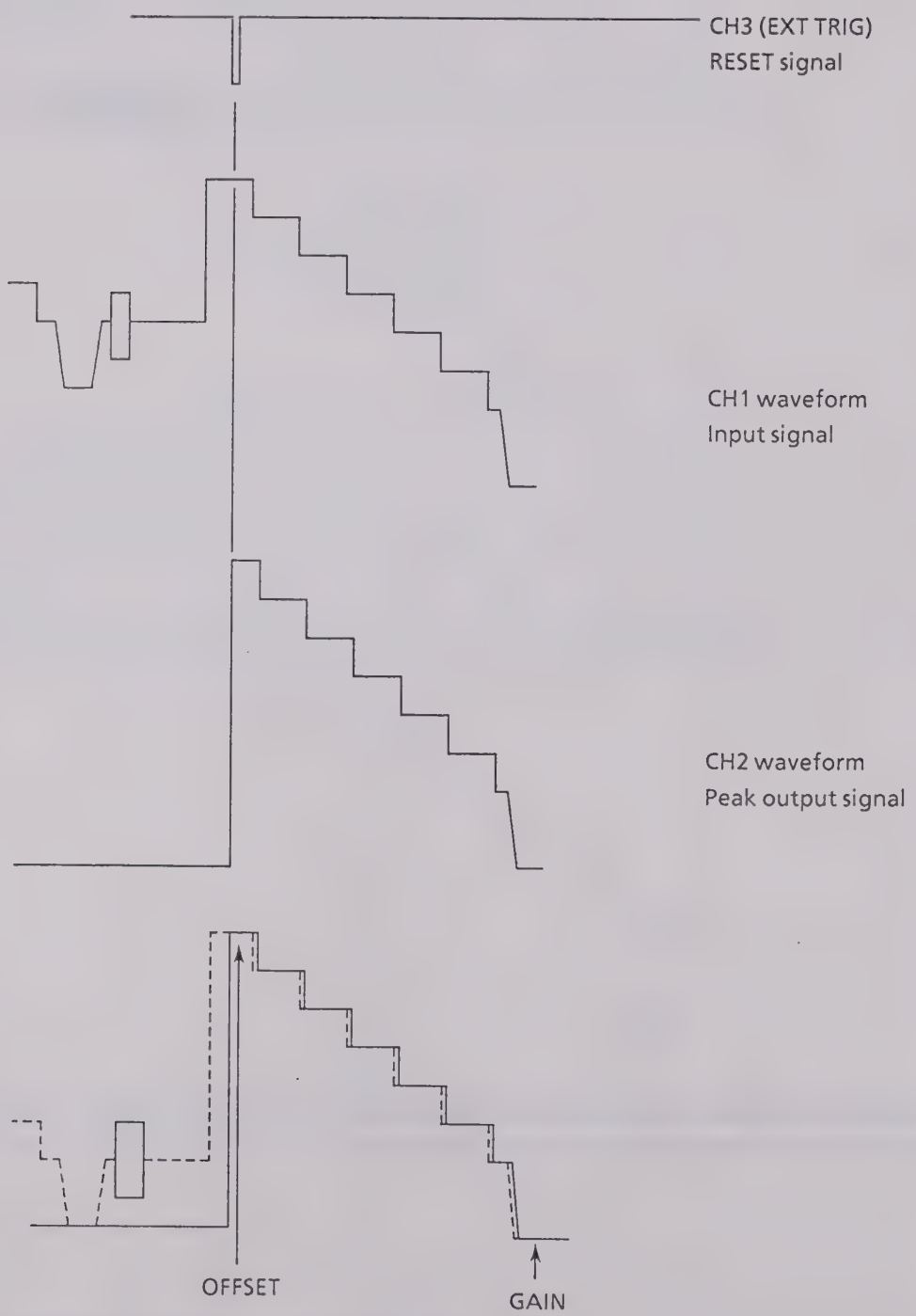
① PANEL SETTING

MEAS FUNC – PEAK

MEAS POS RESET H = 15 μs

V = 150 lines

② Connect CH2 of the oscilloscope to the point B.



- Adjust GAIN ADJ R301 for the luminance top part of the superposed waveforms and OFFSET ADJ R299 for their sink tip part to get an entire superposition.

(3) PEAK-PEAK ADJUSTMENT

① PANEL SETTING

MEAS FUNC PEAK-PEAK
MEAS POS RESET H = 12 μs
V = 150 lines

② Set PAL. 5 steps on VP-8400A.

③ Connect COMPOSITE output of VP-8400A to INPUT on the front panel and press REPEAT KEY on the panel.

④ Set MEASURE POSITION on the L.C.D. to H = 15 μs, 151 lines.

⑤ Set the output level (STD) of VP-8400A to 100% and adjust R296 so as PEAK-PEAK level on the L.C.D. to be 1000 mV ± 3 mV.

⑥ Set the output level (STD) of VP-8400A to 30% and adjust R304 so as PEAK-PEAK level on the L.C.D. to be 300 mV ± 3 mV.

⑦ Repeat the above adjustments to get a good result.

(4) AC PEAK ADJUSTMENT

① PANEL SETTING

MEAS FUNC AC PEAK

② Connect a standard signal generator (hp 3336C) to INPUT on the front panel.

- Make the output of the generator 75 Ω termination.
- Calibrate previously the output level from 100 kHz to 10 MHz and set the output level 1 Vp-p (2.22 dBm, 0.354 Vrms)

③ Set the output frequency of the generator to 100 kHz.

④ Measure the AC PEAK level of the L.C.D.

⑤ Set the frequency of the generator to 3.58 MHz and adjust R297 so as the AC PEAK level to be same as the level on 100 kHz (in ± 5 mV).

SECTION IV
OPERATION

4-1 GENERAL

Described in this section is the basic operation on the VP-8450A front panel. The basic operation includes : operation of video levels, phase measurement, and peak measurement. Besides these basic measurement functions, the instrument has a preset memory function. As external interfaces, it has a GP-IB and EXT CONTROL I/O.

First discussed are the functions and terms particular to this analyzer. Then a brief description of the entire operation panel is provided followed by a detailed explanation of each operation in the sequence given below.

4.5 LCD and function keys
4-6 Measurement function and type of setup items
4-7 Setup operation
4-8 Basic composition and operation of measurement
4-9 Video levels and phase measurement
4-10 Peak measurement
4-11 Error message
4-12 Various output signals
4-13 Associated preset memory
4-14 Auto sequence of associated preset memory

The GP-IB is discussed in sections V and VI, and the EXT CONTROL I/O interface is discussed in section VII. The GP-IB program code list is attached at the rear of this instruction manual.

4-2 FUNCTIONS AND TERMS PARTICULAR TO VP-8450A

(1) Associated preset memory

This is the function for storir.g in the memory the setup conditions in a set and recalls then at once as required. The recalled setup values can be changed as desired. Up to 32 sets of conditions can be stored in the memory. See paragraph 4-13 for details.

(2) Auto sequence

This is the function to automatically carry out sequential recalling of the associated preset memory at a desired interval time. See paragraph 4-14 for details.

Note

The VP-8450A is battery backed up, so the setup conditions reappear unchanged after turning the power once off and then on again.

4-3 FRONT PANEL

Folded at the back of this manual is the panel illustration. Numbers 1 to 16 given to those related to operation are cited in the text. The names and their brief description of functions are given below.

① POWER switch	A push button switch for turning the mains power on or off.
② LCD	240 x 64 dots matrix liquid crystal display module for displaying setup or measurement conditions.
③ Function block	Six keys F 1 to F 6 for selecting the functions to be displayed at the right on LCD ②.
④ MEASUREMENT block	Three keys for selecting one among REPEAT, SINGLE, and STOP for measurement.
⑤ CONTROL block	Four keys for renewing the conditions on the LCD, entering numeric values, and registering and deleting measuring point.
⑥ Jog dial / shuttle ring	〈 Jog dial 〉 (inner control) Changes and moves setup conditions and measuring point. 〈 Shuttle ring 〉 (outer axis) Moves the measuring point. The moving speed of the measuring point can be adjusted with the amount of angle obtained by rotating the ring clockwise or counterclockwise.
⑦ H / V keys	Selects the moving direction of the measuring point. The H key is for horizontal direction (↔) and the V key is for vertical direction (↕).
⑧ Numeric keys	Keys for entering measuring point.
⑨ INPUT connector	A connector for applying signals for measurement.

4-4 REAR PANEL

⑩ INPUT connectors	Connectors for applying signals for measurement. Two for video signal inputs, one each for the Y / C separated signal inputs, and one for the external synchronization.
⑪ OUTPUT connector	A video output with measuring point markers and the detection and timing signal output in peak measurement.
⑫ NOMINAL VOLTAGE switch	Selects power voltage.
⑬ MAINS INPUT connector	An inlet socket for connecting the power cable.
⑭ Fuse holder	Power fuse holder.
⑮ GP-IB connector	A 24-pin connector for connecting the GP-IB interface.
⑯ EXT CONTROL I / O	A 36-pin connector for input and output of external control signals, for the remote controlling of the preset memory, etc.

4-5 LCD AND FUNCTION KEYS

The LCD and the function keys are the major features of the VP-8450A. The LCD used in LCD section 2 is a large-sized dot matrix liquid crystal display module of 240 x 64 dots, which provides the readout of large-sized numerals to show the measured result at a desired measurement point. In addition, the LCD backlight can be turned on / off and the contrast of LCD can be controlled for a clearer display.

To change measuring functions or setup conditions, use the six keys F 1 to F 6 of function block ③. These six keys correspond to F 1 to F 6 at the right of LCD section 2, so that changing any setup condition can be done by pressing the function key having the number identical to the function number at the left of the item to be changed.

Figure 4-1 shows the content of the LCD of a typical video levels and phase measurement.

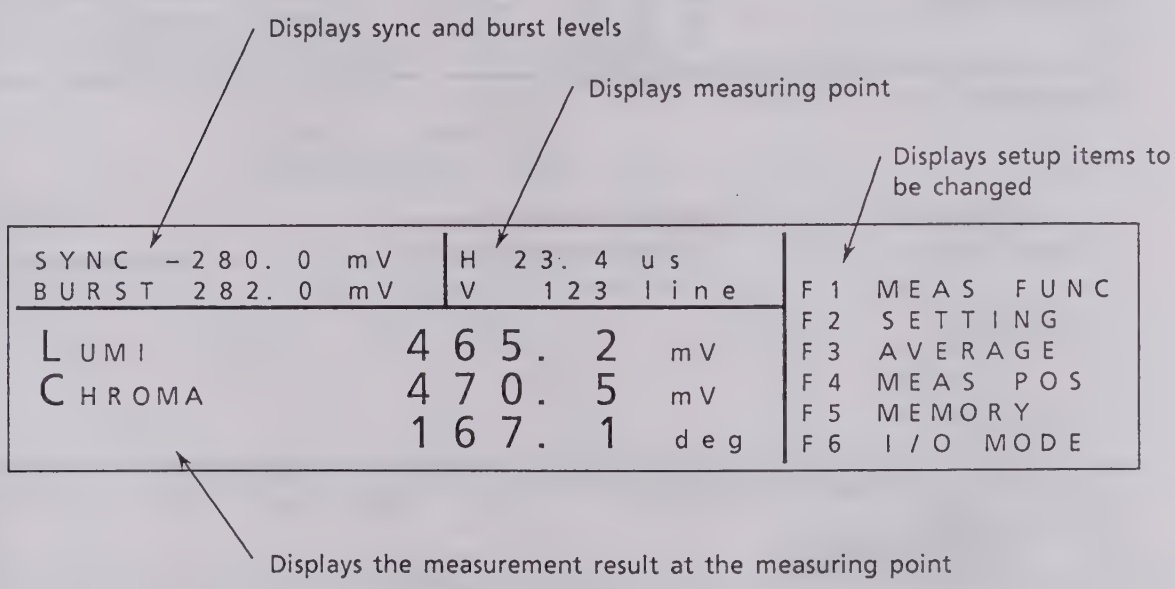


Figure 4-1 LCD content of video levels and phase measurement

As shown in Figure 4-1, the specified measuring point is displayed almost in the upper middle, and the measurement results (luminance level, chrominance level, and chrominance phase) are displayed in large characters at the center. Also displayed at the upper left are the sync and burst levels of the line under measurement.

Besides those readouts given above, the displays for changing the current measurement function or setup conditions appear as F 1 to F 6 on the right. Press the function key with the number equal to that of the item to be changed.

Figure 4-2 below shows, as an example, the procedure for changing the TV system (NTSC or PAL) using the function keys and the content of the LCD.

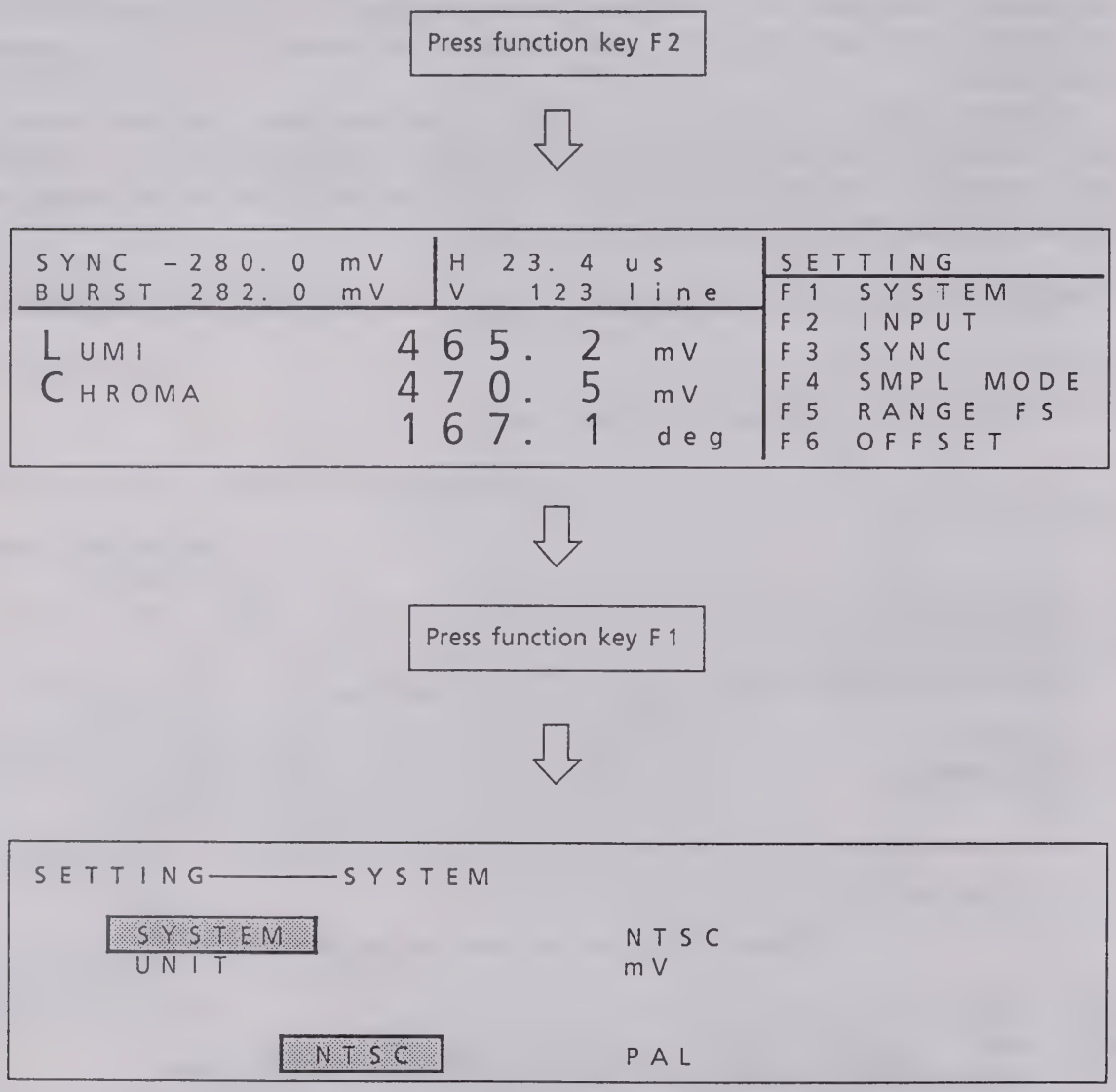


Figure 4-2 Changing the TV system

Press the F1 key to bring the SYSTEM display on screen, and then rotate the jog dial (inner control) of jog dial / shuttle ring 6. Now the TV system can be changed.

4-6 MEASUREMENT FUNCTIONS AND SETUP ITEMS

(1) General

The VP-8450A has several measurement functions to cover all applications in the production process of general video devices. It is required to set conditions in order to obtain results for the desired measurement. Discussed in the following paragraphs are the measurement functions and setup items.

(2) Measurement functions

The major purpose of measurement on the analyzer is to obtain the luminance level, chrominance level, and chrominance phase of a video signal at a desired measuring point. Also provided are the functions of peak measurement, AC measurement, and others.

Figure 4-3 shows the analyzer's measurement functions.

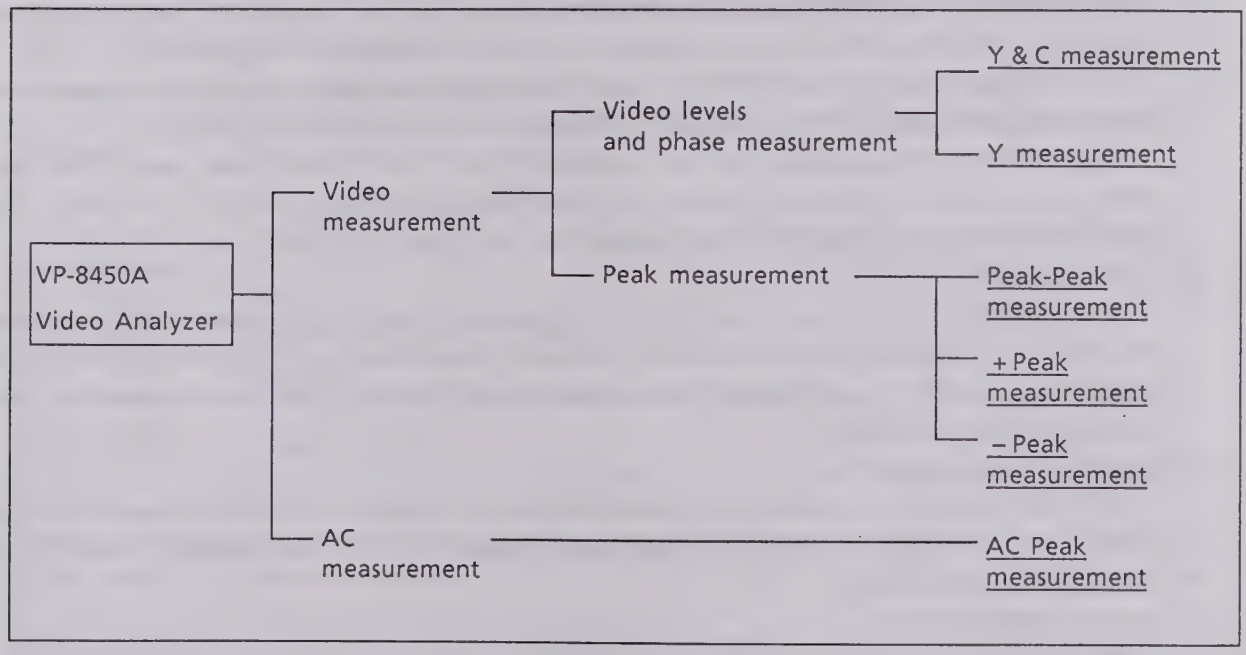


Figure 4-3 Measurement functions

The measurement items under lined in Figure 4-3 are the items to be displayed at the right of the LCD. Each function is to be discussed below ; the functions without underline are to be explained first, followed by those with underline.

① Video measurement and AC measurement

All the functions of the analyzer fall into either the video measurement or the AC measurement. The classification depends on whether the signal to be measured is a video signal or a general AC signal.

The frequency band of the AC signal for the AC measurement must be in the range of 0.1 to 5 MHz.

② Video levels and phase measurement

This is the major-purpose measurement of the analyzer. The internal high-speed A / D converter (10 bit, 20 MS / s) realizes accurate and high speed in the measurement.

③ Peak measurement

The video levels and phase measurement is for mainly measuring the color bar signals or linearity signals, while this Peak measurement is appropriate for measuring the level of various video signals : appropriate for measuring the level of various video signals : for example, the pulse wave height value or the level of the bar in specified area, etc. This function allows a high-speed measurement of each packed frequency level of the horizontal or vertical direction multiburst signals which are most suitable for measuring the frequency response of general video devices.

Here follows the descriptions of the under lined measurement items on Figure 4-3.

④ Y & C measurement

This function is used for measuring the video signal (color bar signals and modulation 5-step signals, etc.) on which the chrominance signal, the color information, is superposed.

The analyzer employs the 16-bit CPU, and 10-bit A / D converter for realizing more accurate and higher-speed measurement compared with our conventional model VP-1671A.

In addition to measurement of the luminance level, chrominance level, and chrominance phase at a desired measuring point, the sync level and burst level of the line under measurement are also measured to be displayed on the same LCD screen.

⑤ Y measurement

This function is used only for obtaining the luminance level of the video signal. Compared with the Y & C measurement in 4 above, it requires less calculation time and provide higher-speed measurement. In addition to the luminance level, the sync level is also measured to be displayed on the LCD screen.

⑥ Peak-Peak measurement

This function is for measuring the peak-to-peak (P-P value) of a desired area of a video signal. This is suitable for making a high-speed measurement of the frequency response and the maximum video level.

⑦ + Peak measurement

This function is for measuring the positive peak value with respect to a desired point of a video signal. It is suitable for measuring the height of a pulse or a bar, for example.

⑧ – Peak measurement

This function is for measuring the negative peak value with respect to a desired point of a video signal. It is suitable for measuring the height of a reverse pulse with respect to the white level.

⑨ AC Peak measurement

This is a measurement item to which applied is the peak detection circuit used within the analyzer for realizing Peak measurement 3 above.

Detects the peak of the area of approximately 100 μs of 0.1 to 5 MHz AC signal and measures the value at the peak.

(3) Setup items

For making measurement with a video or AC signal applied to the analyzer, it is required to set several conditions in advance.

Given in Table 4-2 are the items to be set and their descriptions. Also shown are available / unavailable for each under- lined measurement item discussed in (2) above.

Table 4-2 Setup items and their description

	Item	Description	Y & C	Y	Peak-Peak	+Peak	−Peak	AC Peak
①	TV system	NTSC, PAL	○	○	○	○	○	×
②	Measurement unit	mV, IRE	○	○	○	○	○	×
③	Input connector	Front panel, Rear panel 1 & 2, Rear panel Y/C	○	Only rear panel Y/C is unavailable				
④	Input impedance	75 Ω, HI-Z	○	○	○	○	○	○
⑤	Measurement range	570, 620, 670, 730, 800, 890, 1000, 1140, 1300, 1600 mV	○	○	○	○	○	○
⑥	Offset	NTSC: −280 to 720 mV, 4 mV step PAL: −300 to 700 mV, 4 mV step	○	○	×	×	×	×
⑦	Sample mode	1, 2, 4 fields	○	○	○	○	○	×
⑧	Sync type	Internal sync, external sync, external sync input impedance	○	○	○	○	○	×
⑨	Sync polarity	Negative, positive	○	○	○	○	○	×
⑩	Measuring point	H: 0.1 μs step V: 1 line step	○	○	○	○	○	×
◆	Sync point	0.7 μs ≦ sync < burst (Sets sync level measuring point)	○	○	×	×	×	×
	Burst point	Sync < burst < Measuring point (Sets burst level measuring point)	○	×	×	×	×	×
	Summation average	Number of times: 1, 2, 4, 8, 16, 32, 64	○	○	○	○	○	○
	LCD contrast	256 step numbers	○	○	○	○	○	○
	LCD back light	ON, OFF	○	○	○	○	○	○

○ ··· Available × ··· Unavailable

4-7 SETUP OPERATION

(1) Basic procedure

To set the items given in Table 4-2, use LCD ②, function block ③, CONTROL block ⑤, and jog dial / shuttle ring ⑥ and follow the procedure below.

1. Press twice the EXT key of CONTROL block ⑤ to bring the initial menu at the right on LCD ②.
2. Select on the menu at the right on LCD ② the item to be set and find its function number.
3. Press the function key having the number identical to the function number found in ② above to display on the LCD the content to be set.
4. Watching LCD ②, use the NEXT key of CONTROL block ⑤ and jog dial / shuttle ring ⑥ to set the setup items as desired.

Some setup items require repeating steps 2 and 3 above.

(2) Setup operation

Shown in Fig 4-4 is the setup operation procedure for the Y & C measurement where all setup items given in Table 4-2 are available.

Fig 4-4 shows the procedure which is to be followed sequentially from the left to the right; namely, see [LCD display], press a [Function key], ..., finally, obtained is the [LCD display of the setup].

To display on the LCD the setup content of the sync type ⑧, for example, press the function keys shown as [ ] in Fig 4-4; that is to press F2 [ ] and then F3 [ ].

The procedures for changing the setup content after completing the procedure above are discussed below for each function (① TV system, ③ Input connector, ④ Input impedance, or ⑨ Sync polarity, etc.). To go back to [LCD display] on the left after changing the setup content, press twice the EXIT key of CONTROL block ⑤. Now another setup item is selectable. If the setup content within the same block in [LCD display] display is desired, press only once the NEXT key of CONTROL block ⑤.

Of setup items given in Table 4-2 , items ⑩ Measuring point and ▷ Summation average are excluded in Fig 4-4. This is because it is more convenient to set these items during measurement. Therefore, the detailed explanation of setting these items is given in the later paragraphs where each measurement procedure is discussed.

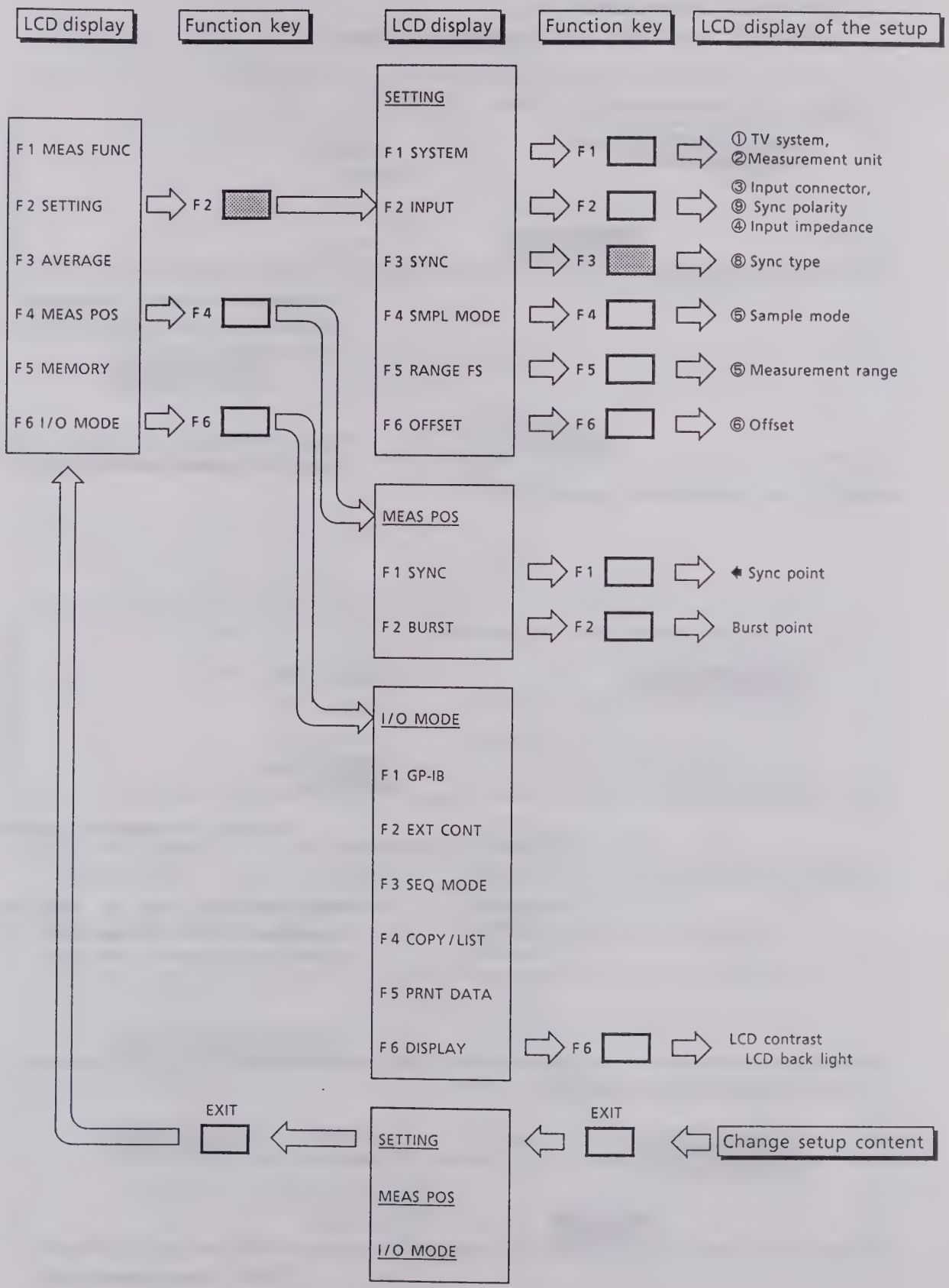
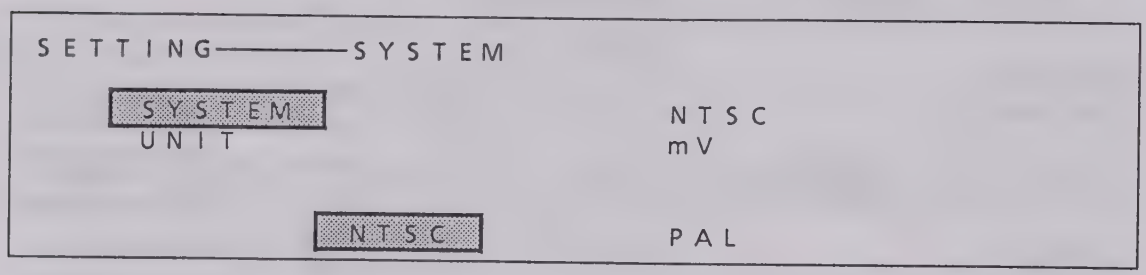


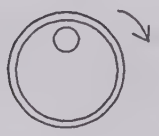
Figure 4-4 Setup operation procedure of Y & C measurement

(a) ① TV system, ② Measurement unit

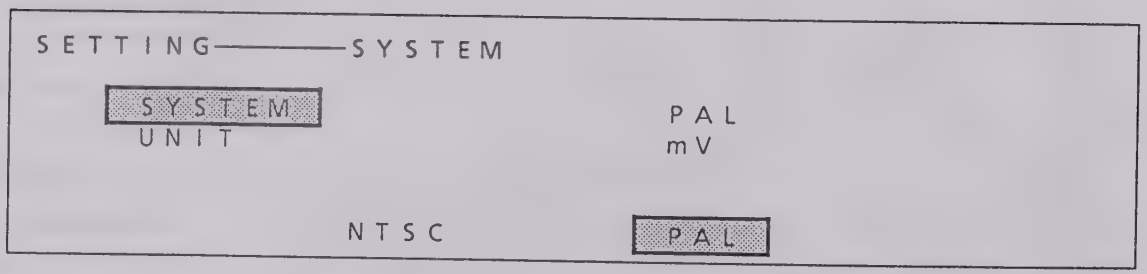
Example 4-1) To change the NTSC system to PAL system.



The system currently selected is displayed in reverse video (NTSC in this example).

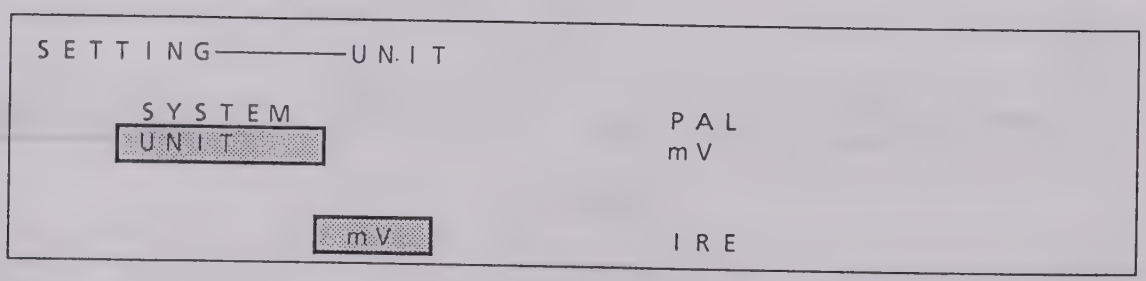


Rotate clockwise the inner or outer control of jog dial / shuttle ring ⑥.

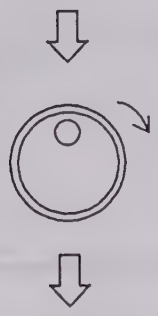


Changing TV system is complete.

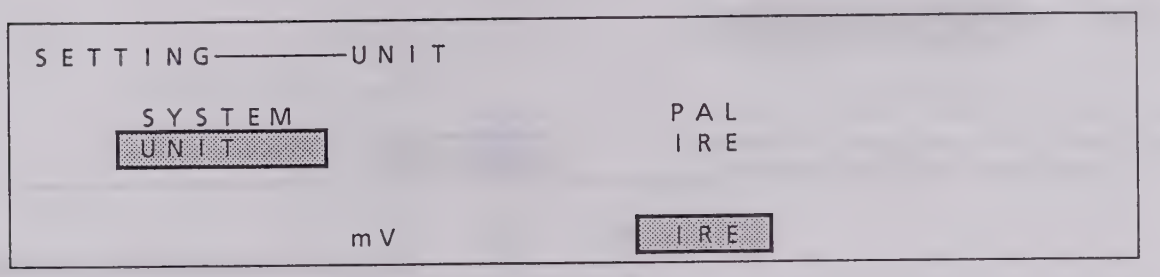
Press the NEXT key of CONTROL block ⑤ to display measurement unit at the right bottom of the LCD.



Measurement unit



Rotate jog dial / shuttle ring ⑥ to display IRE in reverss video.



Changing measurement unit is complete.

Note

"IRE" unit is defined differently in NTSC system or PAL system as follows:

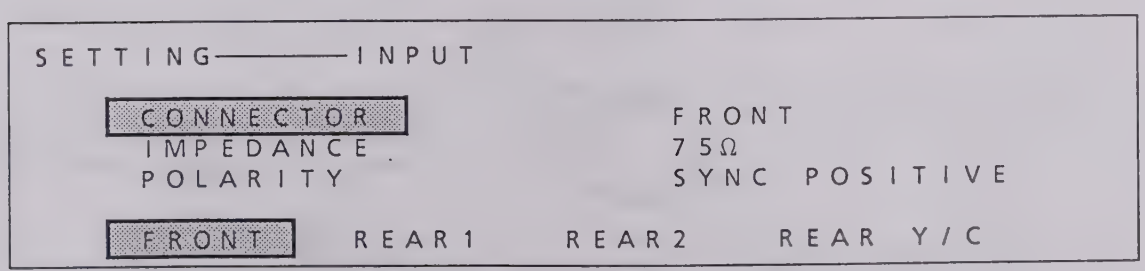
NTSC system ..... 140 IRE = 1 Vp-p

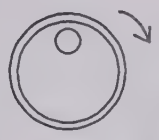
PAL system ..... 100 IRE = 1 Vp-p

(b) ③ Input connector, ④ Input impedance, ⑨ Sync polarity

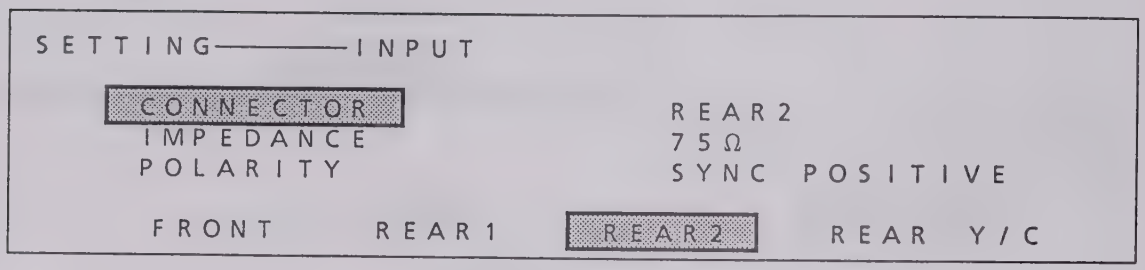
Example 4-2)

- Input connector — To change the front panel to rear panel 2.
- Input impedance — To change 75 Ω to HI-Z.
- Sync polarity — To change positive to negative.



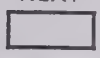


Rotate jog dial / shuttle ring ⑥ to display REAR 2 in reverse video.

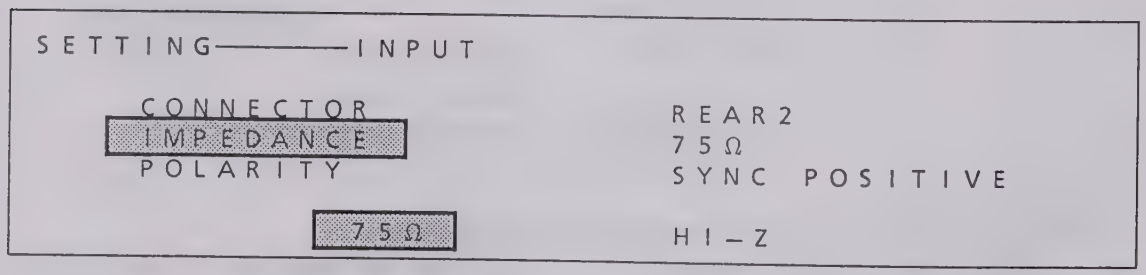


Changing input connector is complete.

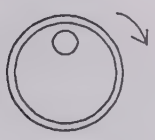
NEXT



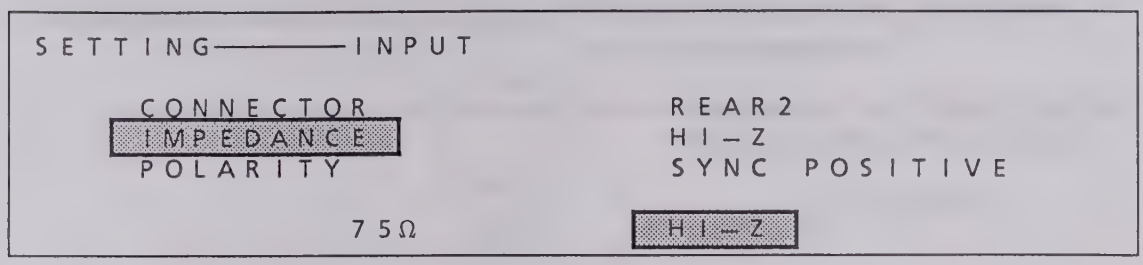
Press the NEXT key of CONTROL block ⑤ to display impedance at the right bottom of the LCD.



Impedance



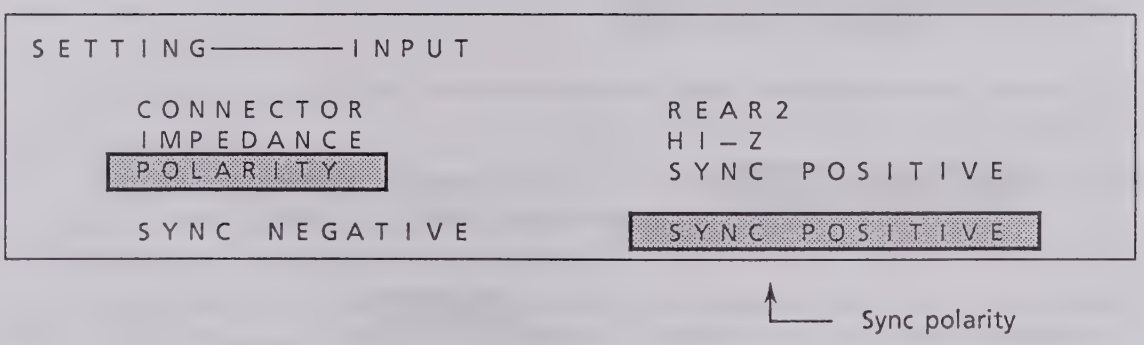
Rotate jog dial / shuttle ring ⑥ to display HI-Z in reverse video.

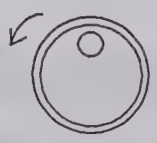


Changing input impedance is complete.

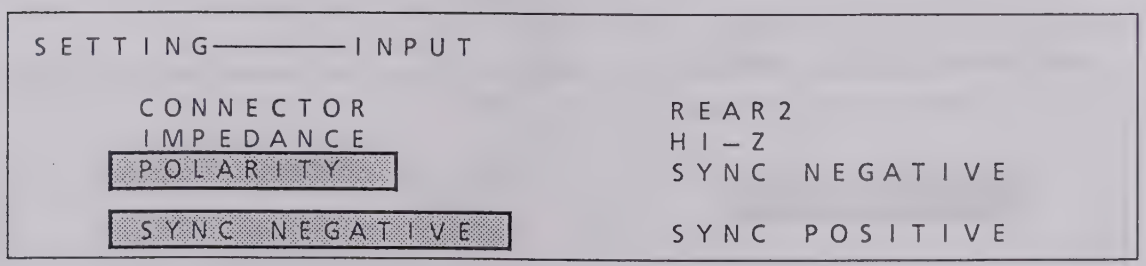
NEXT

Press the NEXT key of CONTROL block ⑤ to display sync polarity at the right bottom of the LCD.





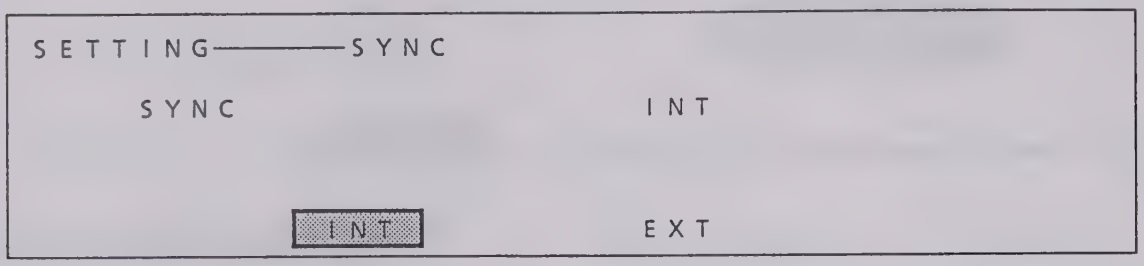
Rotate jog dial / shuttle ring ⑥ to display SYNC NEGATIVE in reverse video.

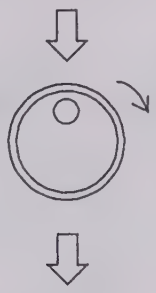


Changing sync polarity is complete.

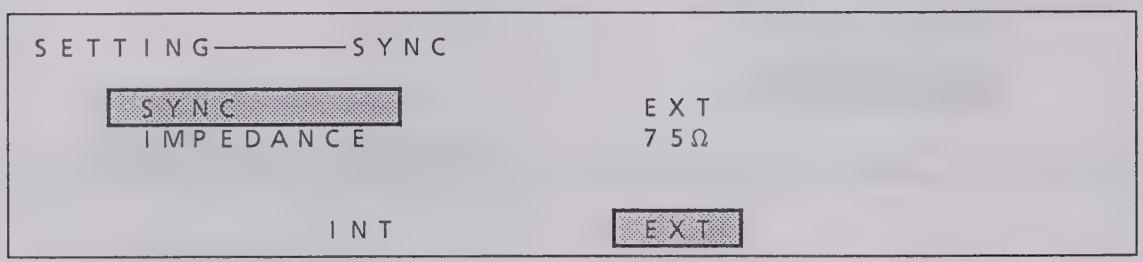
(c) ⑧ Sync type

Example 4-3) To change sync type from internal to external and input impedance 75 Ω of the external sync to HI-Z.





Rotate jog dial / shuttle ring ⑥ to display EXT in reverse video.

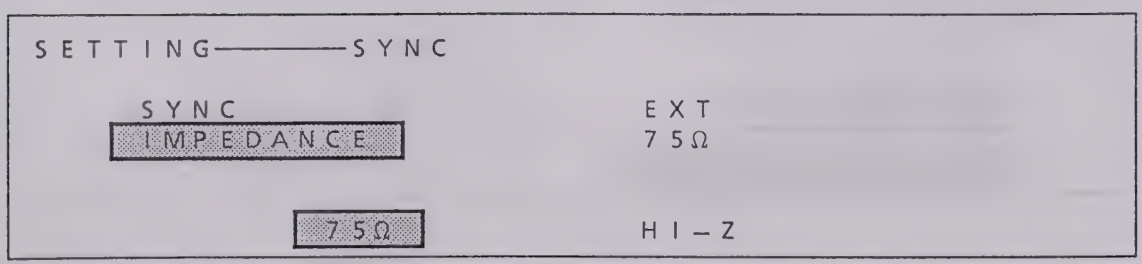


Displaying EXT in reverse video brings impedance on

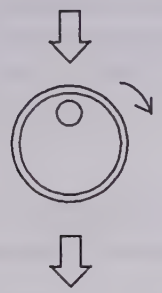
Changing sync from internal to external is complete.

NEXT

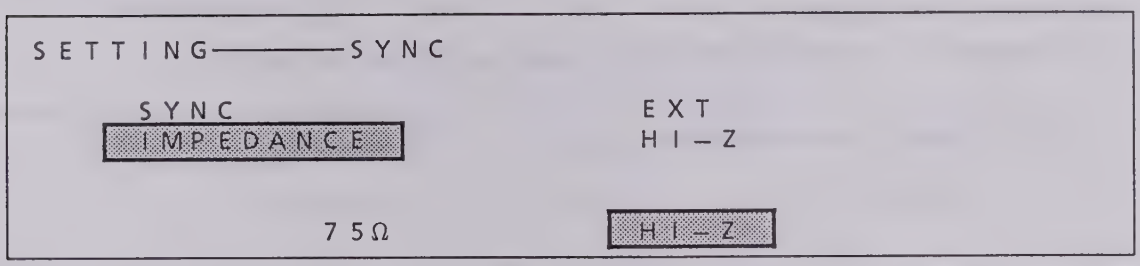
Press the NEXT key of CONTROL block ⑤ to display input impedance at the right bottom of LCD.



Impedance



Rotate jog dial / shuttle ring ⑥ to display HI-Z in reverse video.

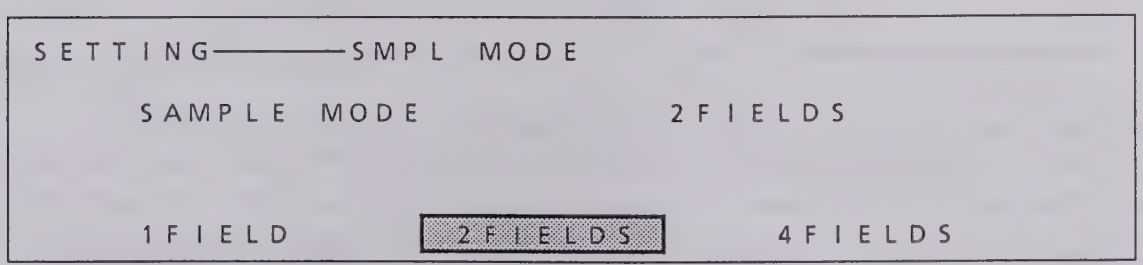


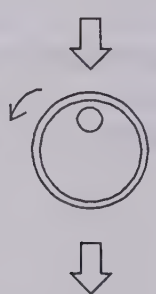
Changing the input impedance of the external sync is complete.

(d) ⑦ Sample mode

The sample mode is a measuring unit in vertical direction when measuring a video signal. 1 field, 2 fields, and 4 fields are available.

Example 4-4) To change 2 fields to 1 field.





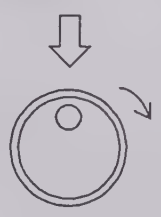
Rotate jog dial / shuttle ring ⑥ to display 1 FIELD in reverse video.

```
SETTING————SMPL MODE

    SAMPLE MODE              1FIELD

  [1FIELD]          2FIELDS          4FIELDS
```

(e) ⑤ Measuring range

Example 4-5) To change 1000 mV (full scale) to 1600 mV (full scale).

```
SETTING————RANGE FS

    RANGE FULL SCALE        1000mV

                [UNIT:mV]
 570      620      670      730      800
 890     [1000]    1140     1300     1600
```



Rotate jog dial / shuttle ring ⑥ to display 1600 mV in reverse video.

```
SETTING————RANGE FS

    RANGE FULL SCALE        1600mV

                [UNIT:mV]
 570      620      670      730      800
 890     1000      1140     1300    [1600]
```

The analyzer has measurement ranges different from those generally employed ; several ranges up to 1600 mV full scale are available. This allows more accurate measurement by setting the measurement result to be obtained as close as possible to the full scale.

When IRE is selected for the unit system, the measurement ranges depending on TV system (NTSC / PAL) are displayed on LCD as follows. The procedure of the measurement range selection is the same as that in mV unit shown in example 4-5.

NTSC

```
SETTING————————RANGE FS

      RANGE FULL SCALE      140.0IRE

                    [UNIT:IRE]
    79.8      86.8      93.8      102.2      112.0
   124.6     [140 0]    159.6      182.0      224.0
```

PAL

```
SETTING————————RANGE FS

      RANGE FULL SCALE      100.0IRE

                    [UNIT:IRE]
    57.0      62.0      67.0      73.0       80.0
    89.0     [100 0]    114.0     130.0      160.0
```

(f) ⑥ Offset

(e) ⑤ Measurement range is set for expanding or shrinking the level of the video signal applied in the analyzer to set the level within the measurable range of the analyzer. On the other hand, offset varies the DC level of the video signal to set the level within the measurable range of the analyzer.

The variable range of the offset is −280 to 0 to 720 mV or −39.2 to 0 to 100.8 IRE in NTSC, and −300 to 0 to 700 mV or −30 to 0 to 70 IRE in PAL. For 1 Vp-p which is the level of a standard video signal, set the offset to 0 mV. The offset may be varied in a step of 4 mV.

Figure 4-5 shows the relationship between the analyzer's internal measuring range and the signal where 100 % white signal is applied and measurement rang is set at 1000 mV (140.0 IRE (NTSC) / 100.0 IRE (PAL)) and offset at 0 mV (0 IRE).

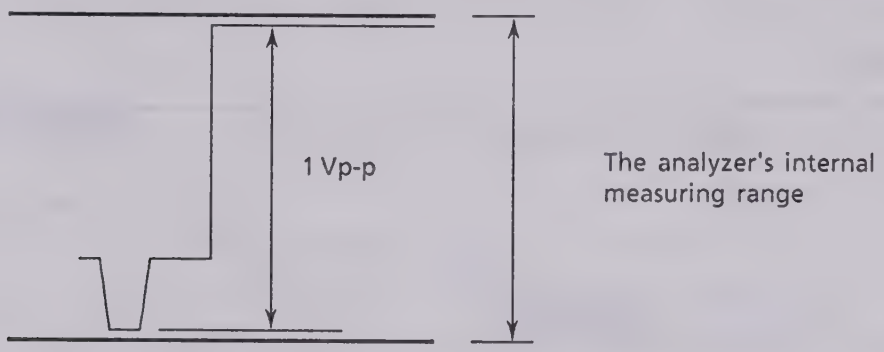


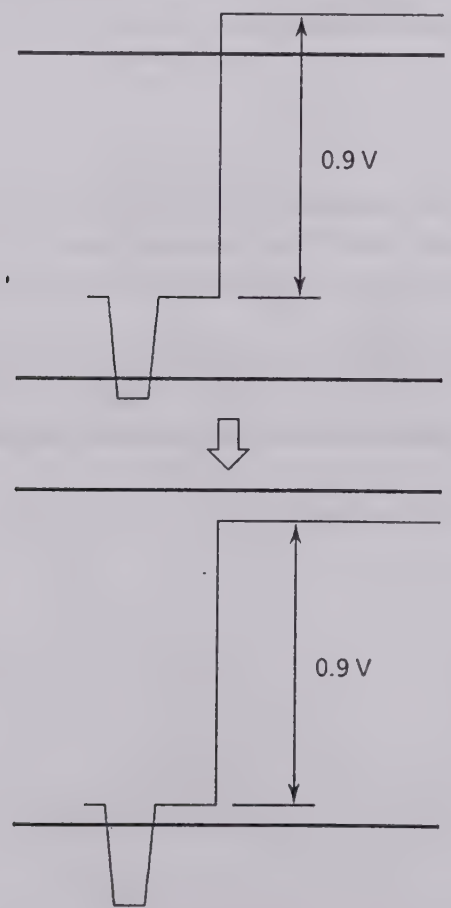
Figure 4-5 Analyzer's internal measuring range

As shown in Figure 4-5, the offset cannot be changed when measuring the sync level and white level with the measuring range set at 1000 mV (140.0 IRE (NTSC) / 100.0 IRE (PAL)) and offset at 0 mV (0 IRE) for the 1 Vp-p video signal. If changed, no correct measurement is assured.

Given below is an example of using the offset.

Example 4-6) To measure the white level of 900 mV of the video signal of over 1 Vp-p.

Set the offset as shown in the figures below to make measurement.

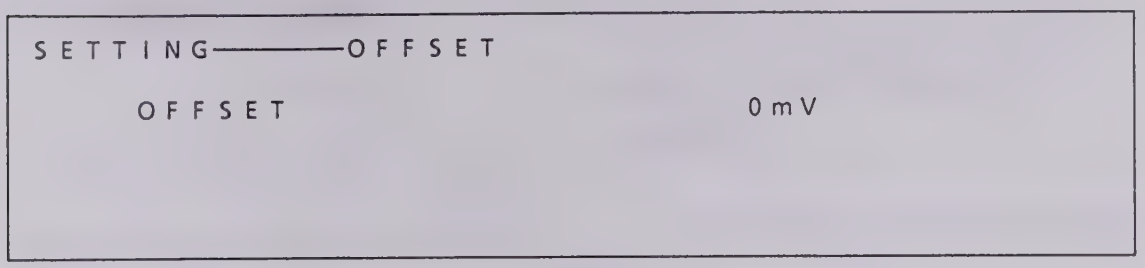


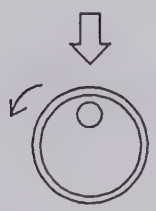
Measuring range : 1000 mV
(140.0 IRE (NTSC) /
100.0 IRE (PAL))
Offset : 0 mV
(0 IRE)

Measuring range : 1000 mV
(140.0 IRE (NTSC) /
100.0 IRE (PAL))
Offset : – 200 mV
(– 28.0 IRE (NTSC) /
– 20.0 IRE (PAL))

Explained below is an example of changing the offset setup.

Example 4-7) To change the offset from 0 mV to – 200 mV.

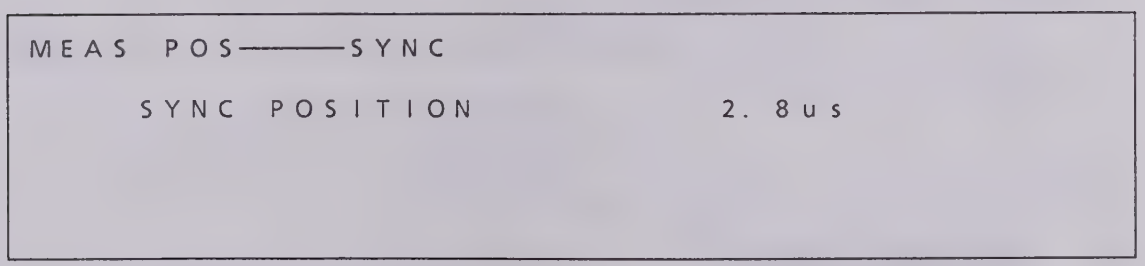


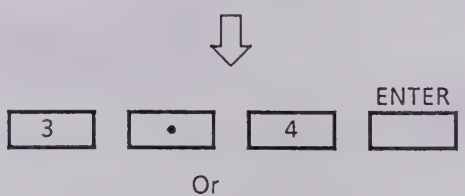


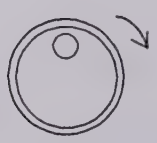
Rotate jog dial / shuttle ring ⑥ to display – 200 mV.

(g) Ω Sync point

Example 4-8) To change sync point 2.8 μs to 3.4 μs.







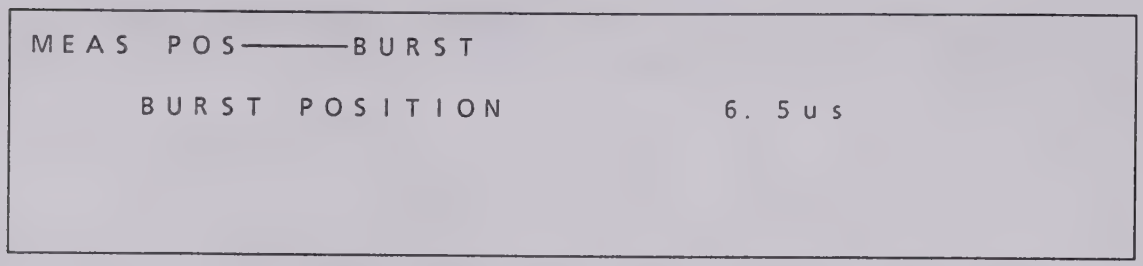
Operate numeric keys ⑧ and the ENTER key of CONTROL block ⑤ or rotate jog dial / shuttle ring ⑥ to display 3.4 μs.

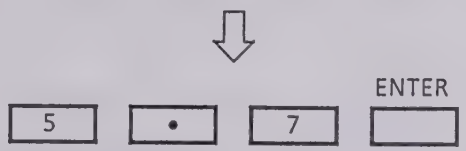
Note

Set sync point value smaller than the burst point value.

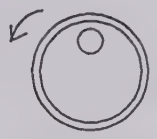
(h) Ω Burst point

Example 4-9) Change burst point 6.5 μs to 5.7 μs.





Or

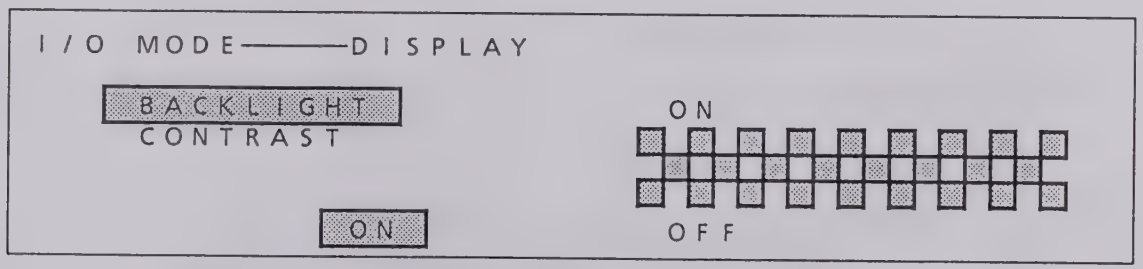


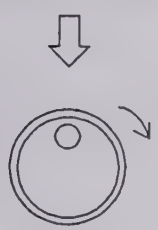
Operate numeric keys ⑧ and the ENTER key of CONTROL block ⑤ or rotate jog dial / shuttle ring ⑥ to display 5.7 μs.

(i) ◁ LCD contrast, Ω LCD backlight

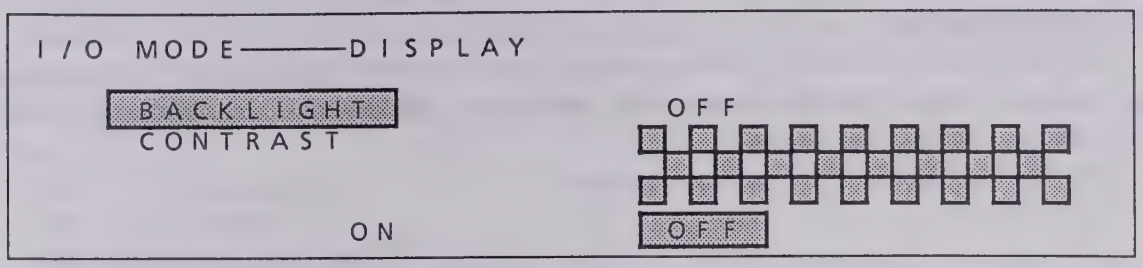
Setup items (a) through (h) are for making measurement, while this ◁ and Ω are for making the LCD easier to watch.

Example 4-10) To turn off the LCD backlight and adjust the LCD contrast.



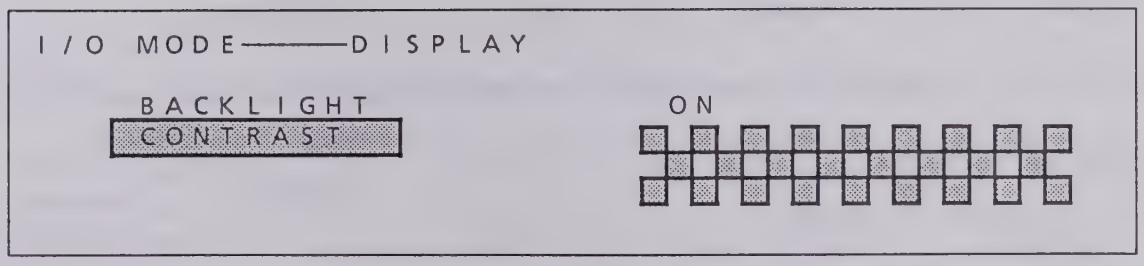


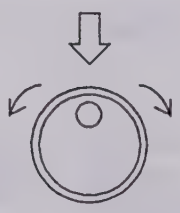
Rotate jog dial / shuttle ring ⑥ to display OFF in reverse video.



Changing back light status is complete.

Press the NEXT key of CONTROL block ⑤ to delete BACKLIGHT ON OFF at the bottom of the LCD.





Rotate jog dial / shuttle ring ⑥ to adjust the contrast of LCD.

4-8 BASIC CONFIGURATION AND OPERATION OF MEASUREMENT

(1) Basic configuration

The large LCD is provided for easier operation, but for further accuracy and faster measurement use a color monitor for the video levels and phase measurement, and a color monitor and oscilloscope for peak measurement.

See Figures 4-6 and 4-7 for the configuration.

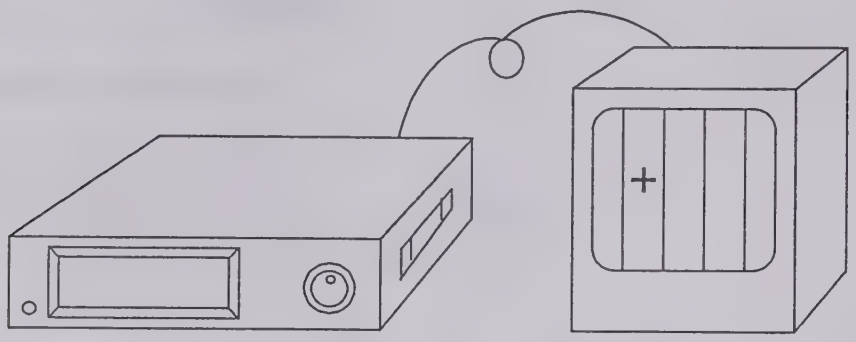


Figure 4-6 Basic configuration for video levels and phase measurement

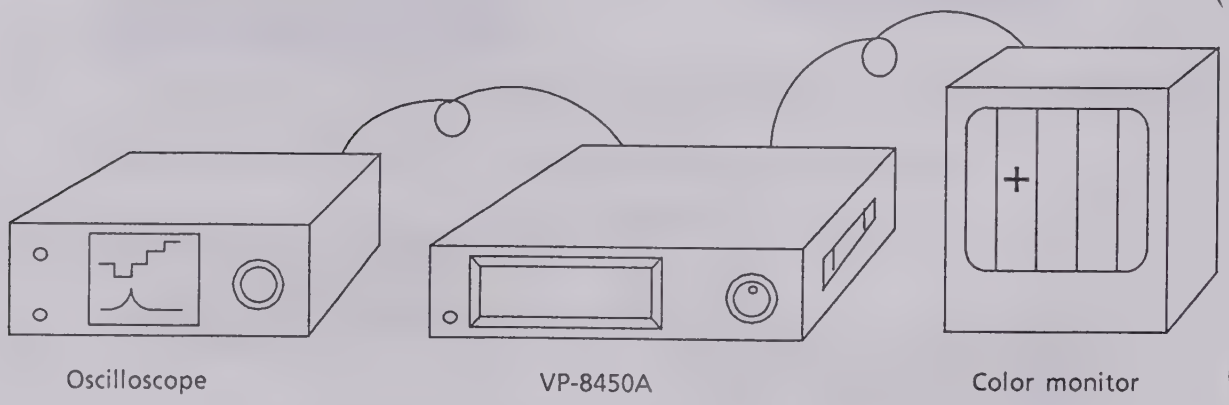


Figure 4-7 Basic configuration for peak measurement

(2) Basic operation

The analyzer's basic operation includes:

① Selecting measurement functions.
② Shifting measuring point.
③ Determining the number of times of summation average.
④ Registering and deleting measuring points.

As for ④, registering means to store each measuring point inside the analyzer and deleting means to erase the registered measuring point when two or more measuring points are required in a measurement such as measuring each bar of a color bar signal.

(3) Selecting measurement function

Described in this paragraph is how to select the desired measurement function prior to making measurement.

The measurement functions shown underlined in Figure 4-3 (Measurement function) are as follows :

① Y & C measurement
② Y measurement
③ Peak-Peak measurement
④ + PEAK measurement
⑤ – PEAK measurement
⑥ AC Peak measurement

Figure 4-8 shows the procedure for selecting each of these measurement functions.

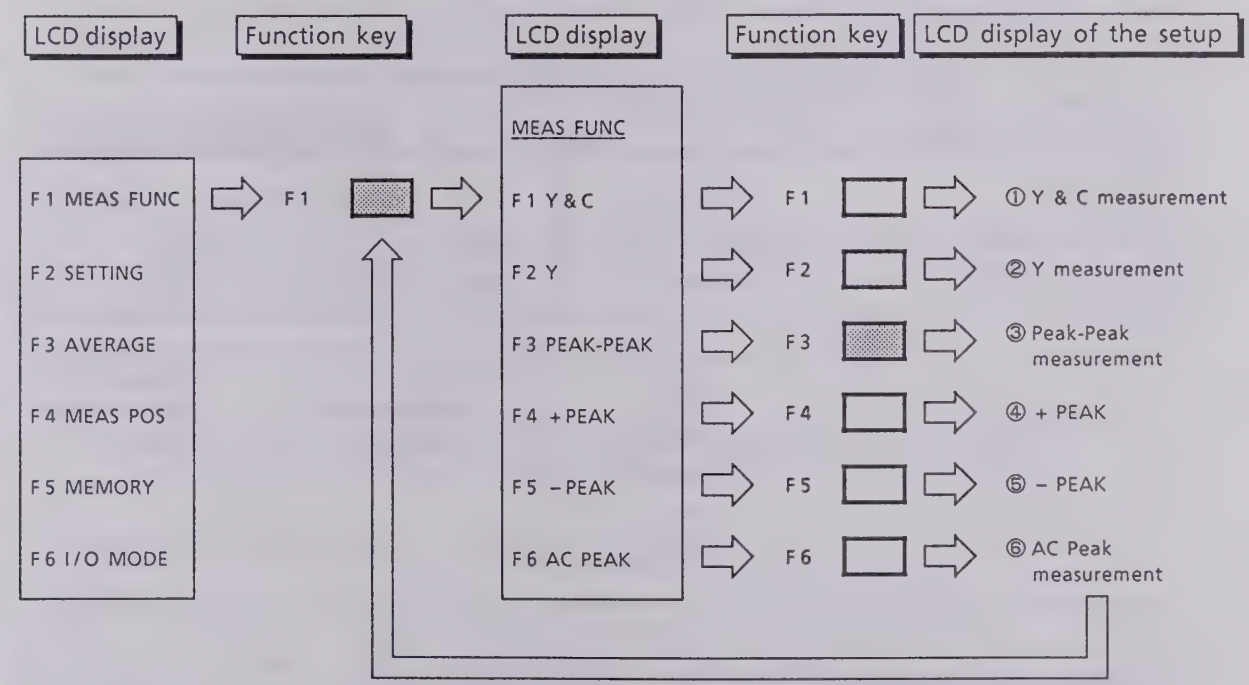
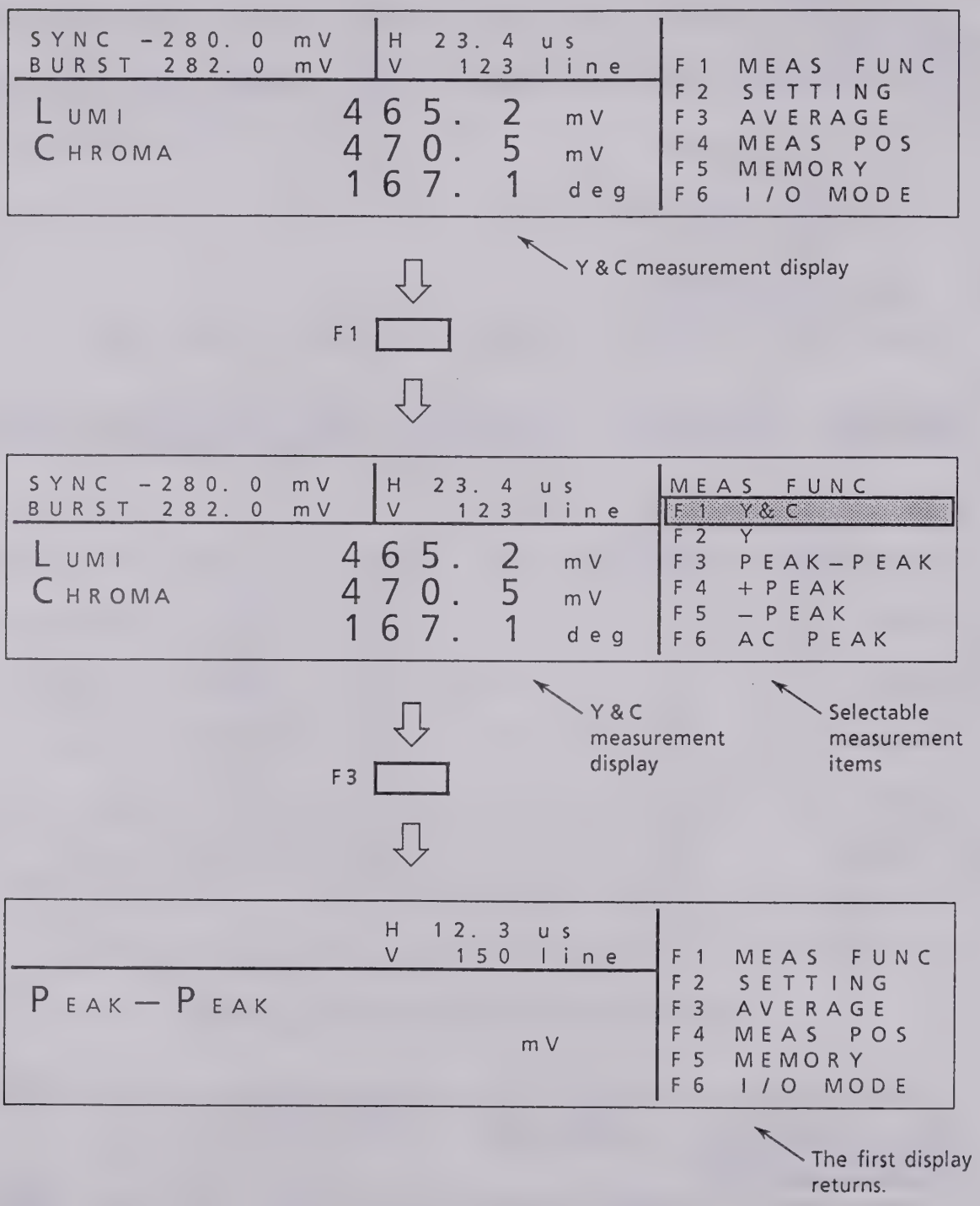


Figure 4-8 Procedure for selecting measurement function

Figure 4-8 shows the procedure which is to be followed sequentially from the left to the right; namely, see LCD display, press Function key, ... , finally, obtained is the LCD display of the setup.

To select Peak-Peak measurement, for example, press the function keys shown as ▒ in Figure 4-8 ; that is to press F1 ▒ and then F3 ▒ .



Note

To make measurement of an AC signal, be sure to set the analyzer in the AC Peak measurement mode before applying the signal.
To make measurement of a video signal, be sure to apply the signal before setting the analyzer in the video measurement mode ; otherwise, measurement results may be unreliable.

4-9 VIDEO LEVELS AND PHASE MEASUREMENT

This is the principal measurement function of the analyzer which measures the luminance level, chrominance level, and chrominance phase at a desired measuring point.

① Y & C measurement

Figure 4-9 shows a display example of the Y & C measurement on the LCD.

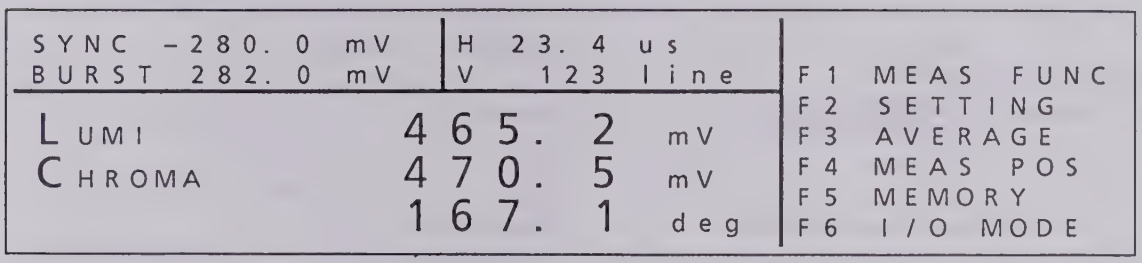
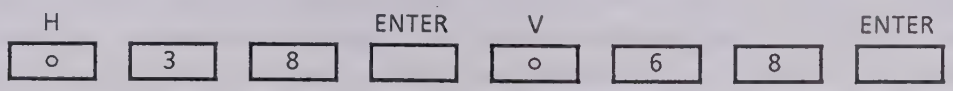


Figure 4-9 An example display of the Y & C measurement

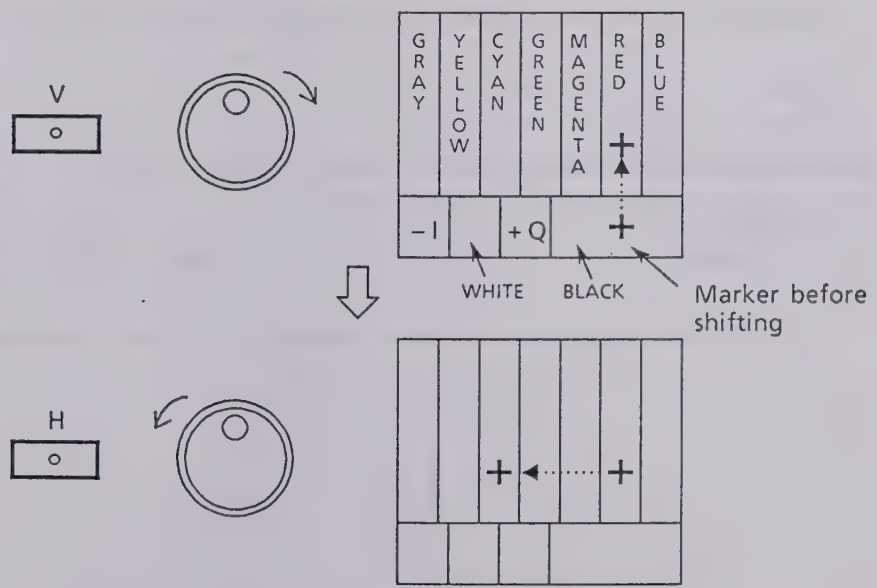
(1) Shifting the measuring point

The measuring point can be shifted in two ways; using numeric keys ⑧ to operate with the numeric data of H and V specified in advance, or using jog dial / shuttle ring ⑥ to shift the point by watching the marker on the color monitor.

Example 4-11) To shift the measuring point to H:38.0 μs and V: 68th line.



Example 4-12) To measure the cyan of the EIA color bar signal.



(2) Determining the number of times of summation average

The summation average aims at obtaining a stable measurement result after averaging two or more data. The analyzer provides two types of summation averages shown in Fig 4-10 ; obtaining summation average of a consecutive lines and that of a consecutive fields.

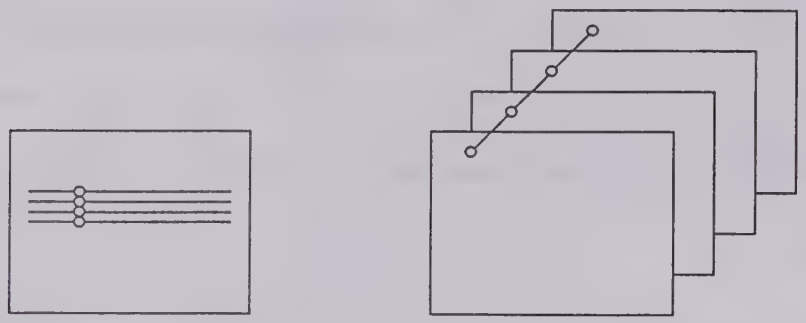


Figure 4-10 Summation average

A consecutive lines are displayed as "LINE", and a consecutive fields as "NUMBER" on the LCD.

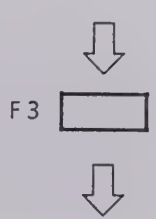
To determining the number of times of summation average, start measurement. This operation uses MEASUREMENT block ④.

Press the REPEAT key to confirm that the repeated measurement results are displayed on the LCD. Examining the results reveals which digits of the measured value are unstable and how they are unstable. To find out the detailed state of the unstable measurement, press the STOP key once and then the SINGLE key for several times. Every time the SINGLE key is pressed, the measured value of a measurement is displayed.

After completing the above operation, specify the number of times of summation average.

Example 4-13) To specify 8 times of summation average for LINE and NUMBER, respectively.

SYNC -280.0 mV BURST 282.0 mV	H 23.4 us V 123 line	F1 MEAS FUNC F2 SETTING F3 AVERAGE F4 MEAS POS F5 MEMORY F6 I/O MODE
LUMI 465.2 mV CHROMA 470.5 mV 167.1 deg		

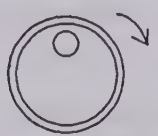


SYNC −280.0 mV	H 23.4 us	AVERAGE
BURST 282.0 mV	V 123 line	F1 NUMBER
		F2 LINE
LUMI 465.2 mV		
CHROMA 470.5 mV		
167.1 deg		

Averaged results are to be displayed here.

F1

AVERAGE——NUMBER
NUMBER OF AVERAGE 1

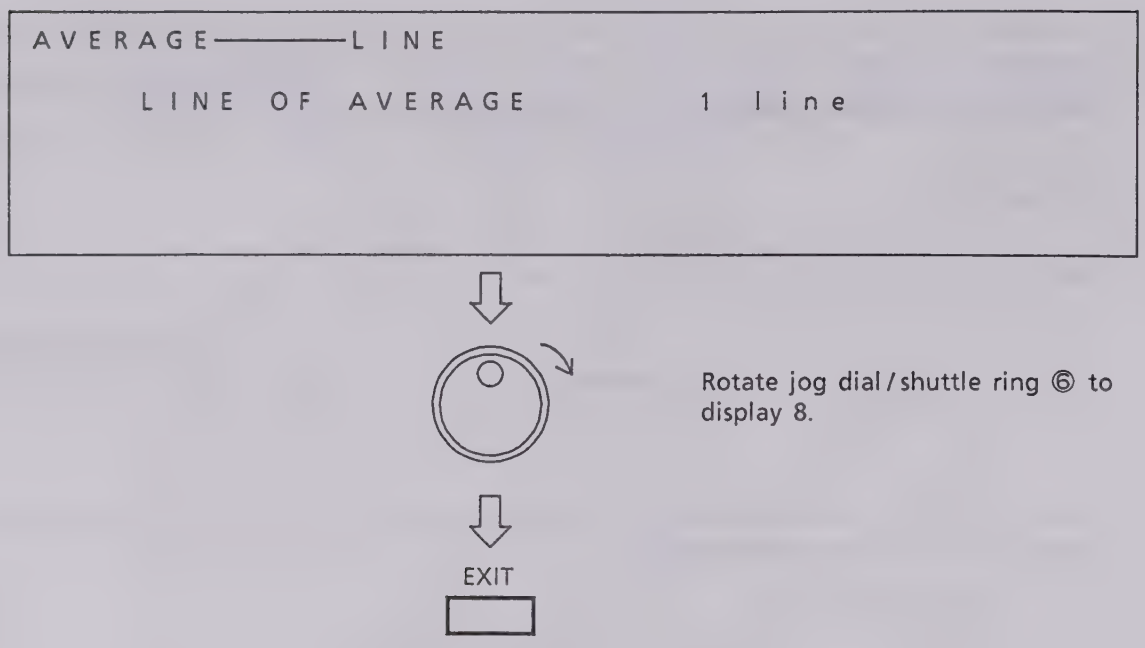


Rotate jog dial / shuttle ring ⑥ to display 8.

EXIT

SYNC −280.0 mV	H 23.4 us	AVERAGE
BURST 282.0 mV	V 123 line	F1 NUMBER
		F2 LINE
LUMI 465.2 mV		
CHROMA 470.5 mV		
167.1 deg		

F2



Rotate jog dial / shuttle ring ⑥ to display 8.

Note

The number of times of the maximum summation average available on the analyzer is 64. Measurement is allowed for 64 times or less which is the product of the numbers of times for LINE and NUMBER.

(3) Registering and deleting of measuring point

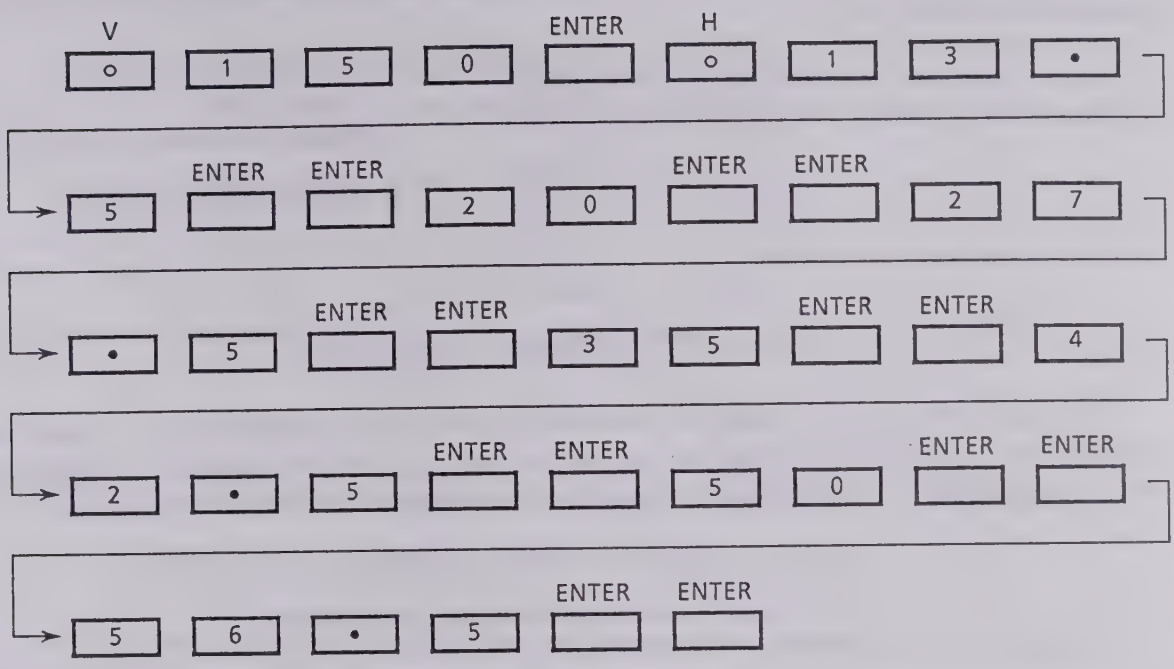
Upon completion of determining the number of times of summation average, the measurement at the desired measuring point is completed. If measurement is to be made at two or more measuring points on a video signal (for example, measurement of each bar of a color bar signal), the measuring points requires to be registered and deleted.

To register a measuring point, first move the measuring point and then press the ENTER key of CONTROL block ⑤. Repeating this operation registers two or more measuring points. To delete the registered measuring point, select with the NEXT key of CONTROL block ⑤ the point to be deleted and press the DEL key.

Since moving measuring points for registration requires the same operation as (1) above, both numeric keys ⑧ and jog dial / shuttle ring ⑥ can be used.

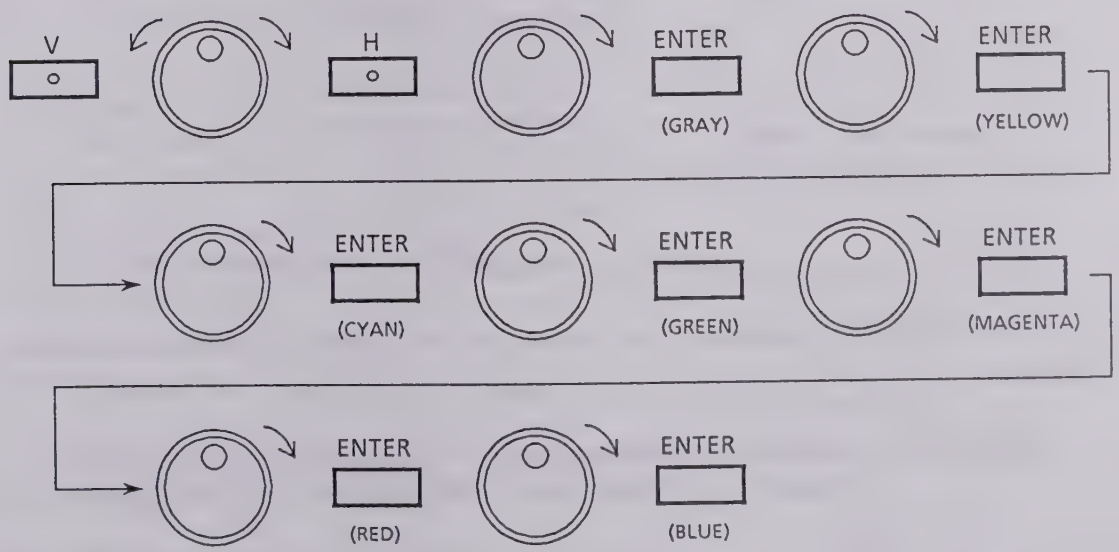
Example 4-14) To register, using numeric keys ⑧, the measuring point of each bar of the color bar signal on the identical line shown below.

Gray :	H = 13.5 μs	V = Line 150
Yellow :	H = 20.0 μs	V = Line 150
Cyan :	H = 27.5 μs	V = Line 150
Green :	H = 35.0 μs	V = Line 150
Magenta :	H = 42.5 μs	V = Line 150
Red :	H = 50.0 μs	V = Line 150
Blue :	H = 56.5 μs	V = Line 150



The first pressing of the ENTER key enters the horizontal numeric value of the measuring point, and the second registers the measuring point.

Example 4-15) To register, using jog dial / shuttle ring ⑥, the measuring point of each bar of the color bar signal on the identical line.



Shown in Figure 4-11 on the color monitor screen are the measuring points registered in examples 4-14 and 4-15.

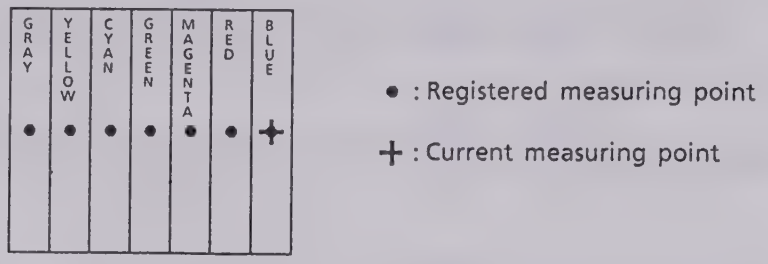


Figure 4-11 Registered measuring points

Examples 4-14 and 4-15 handle the measuring points on the identical line. Registering the measuring points on different lines can be done by adding a vertical operation (V) (using the key and numeric key ⑧, or jog dial / shuttle ring ⑥) to the operation of each measuring point.

Note

Up to 256 measuring points can be registered.

To confirm the registered measuring points, press the NEXT key of CONTROL block ⑤. Every time the NEXT key is pressed, the + mark moves on the registered measuring points from the top left point on the monitor screen to the bottom right one.

Figure 4-12 shows the + mark moving sequentially on the registered measuring points registered in Figure 4-11.

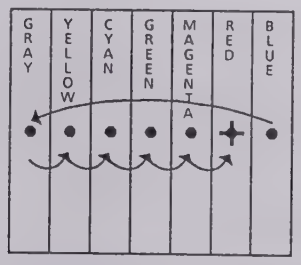
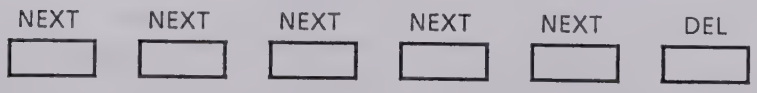


Figure 4-12 After the NEXT key is pressed

In the following paragraphs, the procedure for deleting registered measuring points is discussed.

Example 4-16) To delete the measuring point of magenta out of those registered in examples 4-14 and 4-15. Given below is the operation from the state shown in Figure 4-11.



The color monitor screen upon completion of the above procedure displays the "+" mark only with the "•" mark on magenta deleted.

② Y measurement

The Y measurement measures only the luminance level of the desired measuring point. Compared with Y & C measurement, it requires less calculation time and allows higher-speed measurement.

Figure 4-13 shows a display example of the Y measurement on the LCD.

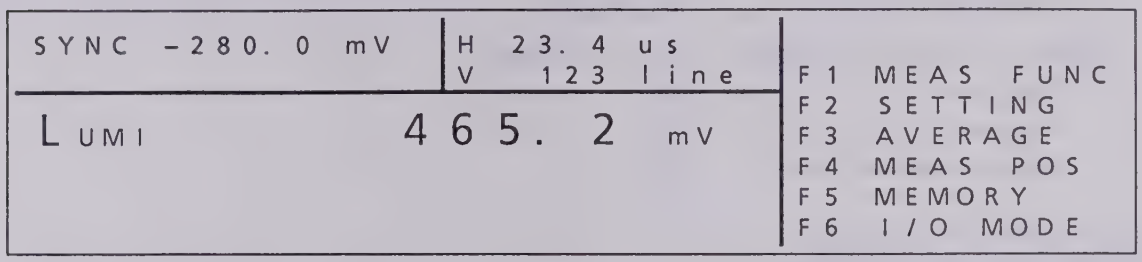


Figure 4-13 An example display of the Y measurement

Figure 4-13 (Y measurement display example) excludes burst level, chrominance level, and phase which are displayed in Figure 4-9 (Y & C measurement display example).

The Y measurement includes : (1) Moving measuring points, (2) Determining the number of times of summation average, and (3) Registering and deleting of measuring points.

The operation procedure for the above measurement is identical to that for Y & C measurement. See the operation description of Y & C measurement.

4-10 PEAK MEASUREMENT

Figure 4-14 shows the block diagram of the peak measurement.

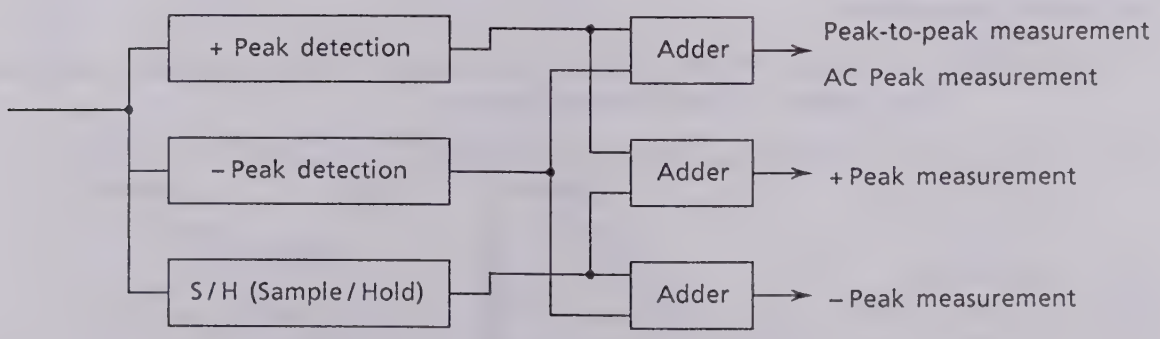


Figure 4-14 Peak measurement block diagram

The Peak-to-peak measurement and the AC Peak measurement sum up the + Peak detected signal and the - Peak detected signal. + Peak measurement sums up the + Peak detected signal and the S/H-processed signal. - Peak measurement sums - Peak detected signal and the S/H processed signal. Then the measurement result for each of the measurements is obtained by A/D converting the sum calculated as mentioned above.

(1) Setting timing for peak measurement

The peak measurement is to obtain the peak value of a de- sired period and therefore requires to set the start point and end point for specifying the desired period. The + Peak and – Peak measurements require setting a desired point for reference. These points are represented as follows on the LCD.

Start point ..... RESET
End point ..... Measuring point of video measurement (H ___ . __ μs / V ____ line)
Desired reference point .... REFERENCE

These are displayed on a color monitor as follows:

Start point .....
End point .....
Desired reference point ...

(2) Peak-to-peak measurement

Figure 4-15 gives an example display of the Peak-to-peak measurement.

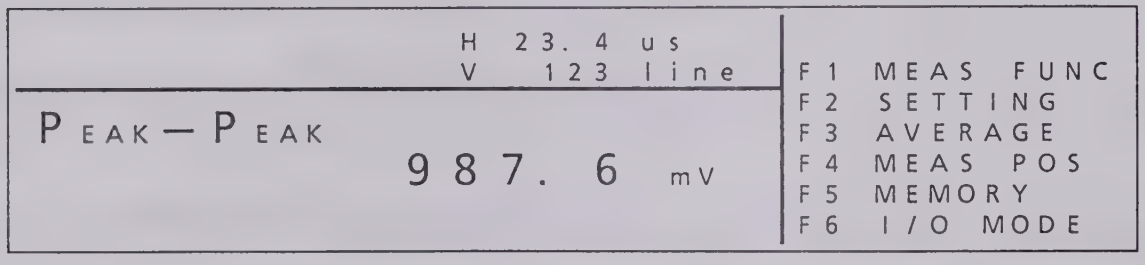
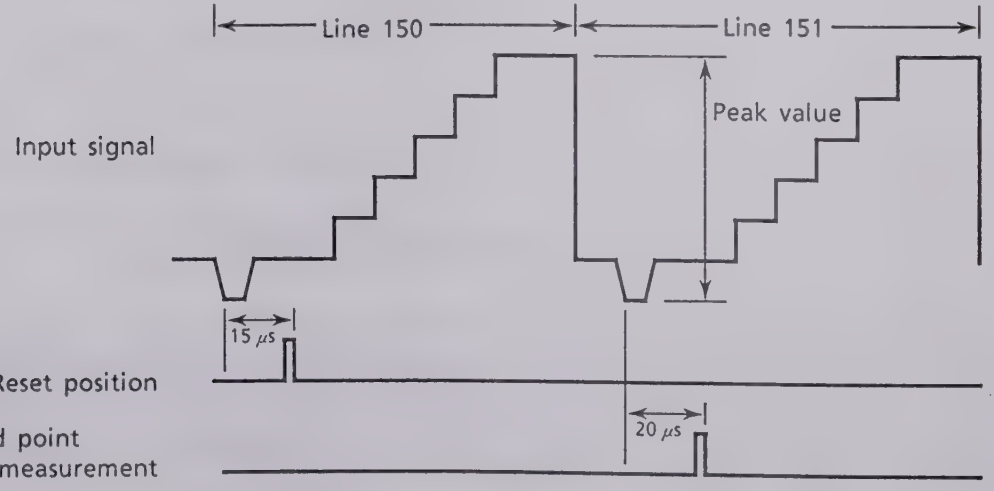
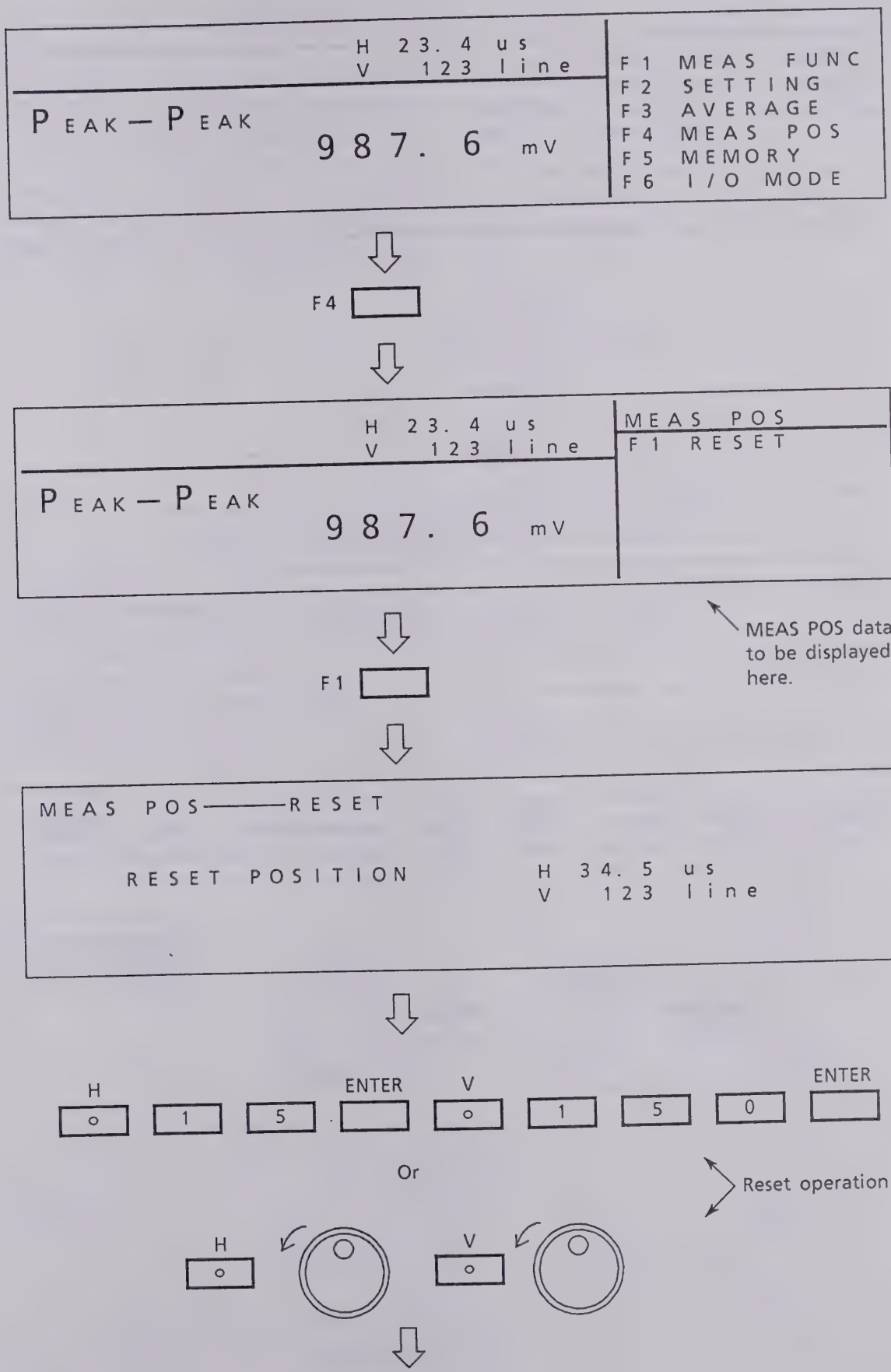


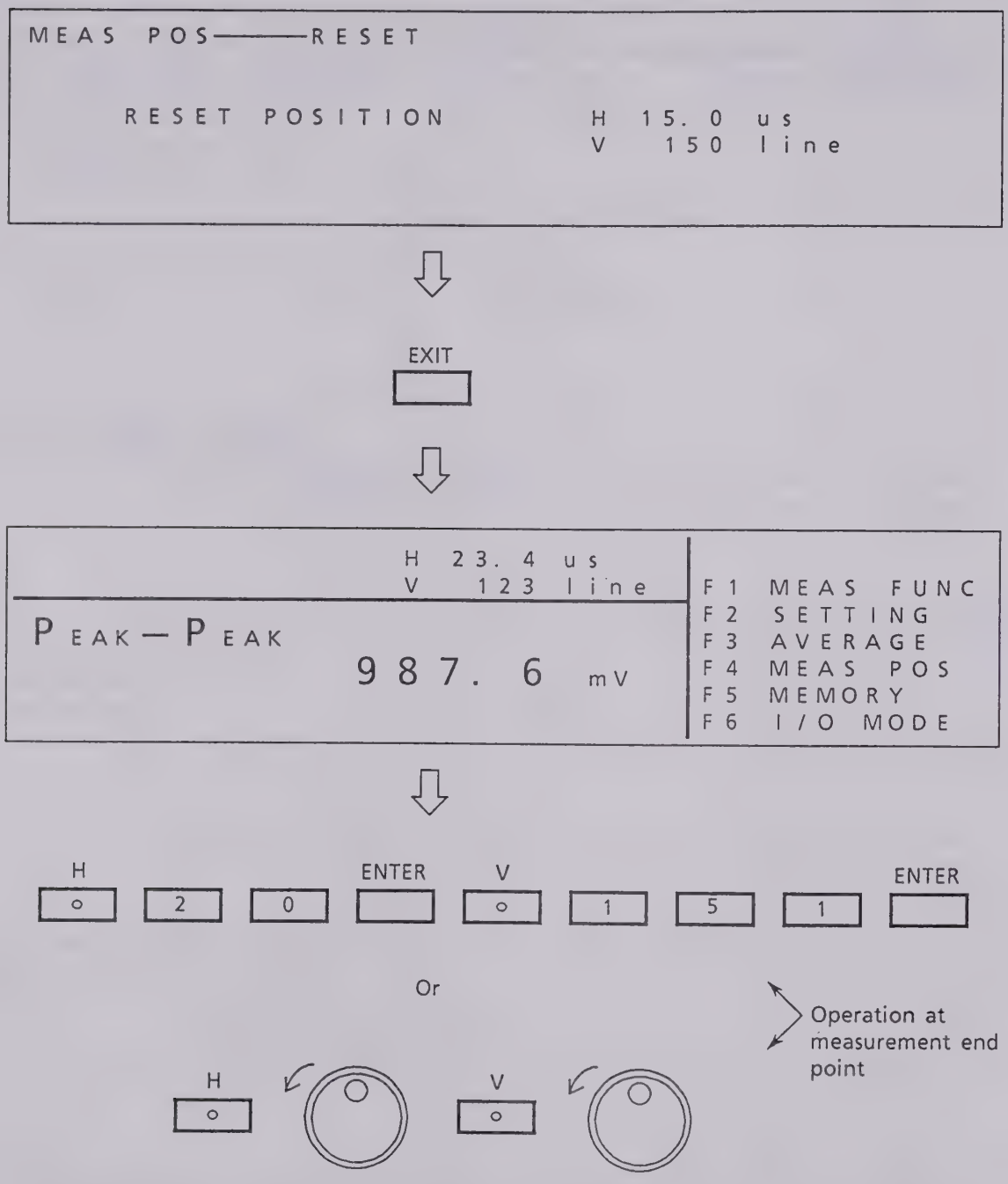
Figure 4-15 An example display of the Peak-to-peak measurement

In Figure 4-15, the H and V displayed at the top center of the screen indicates the end of the Peak-to-peak measurement.

Example 4-17) To measure the peak value of a step signal. The figure below indicated the reset position and measurement end point.

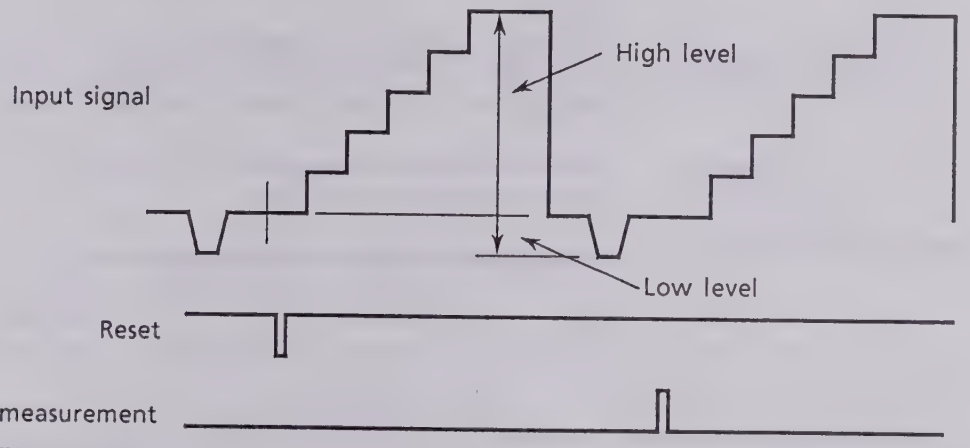



H 23.4 us
V 123 line
PEAK—PEAK
987.6 mV
F1 MEAS FUNC
F2 SETTING
F3 AVERAGE
F4 MEAS POS
F5 MEMORY
F6 I/O MODE
F4
H 23.4 us
V 123 line
PEAK—PEAK
987.6 mV
MEAS POS
F1 RESET
MEAS POS data are to be displayed here.
F1
MEAS POS——RESET
RESET POSITION
H 34.5 us
V 123 line
H
0
1
5
ENTER
V
0
1
5
0
ENTER
Or
Reset operation
H
0
V
0


MEAS POS———RESET
RESET POSITION
H 15.0 us
V 150 line
EXIT
H 23.4 us
V 123 line
PEAK—PEAK
987.6 mV
F1 MEAS FUNC
F2 SETTING
F3 AVERAGE
F4 MEAS POS
F5 MEMORY
F6 I/O MODE
H
2
0
ENTER
V
1
5
1
ENTER
Or
H
V
Operation at measurement end point

Note

1. The numeric value at the end point of measurement must be set larger than that at the reset point; otherwise, peak detection is to be performed all the period to the next field preventing an accurate measurement.
2. Set 100 μs or less for the period between the reset point and the end point of measurement; otherwise, proper measurement cannot be expected.
3. Reliable measurement result cannot be obtained unless there exist higher and lower levels with reference to the level at the reset point.



(3) + Peak measurement, – Peak measurement

In addition to the setting of the reset point and measuring end point, this measurement also requires the setting of the desired reference point.

Given in Figure 4-16 is an example displayed on LCD of the + Peak measurement and in Figure 4-17 is an example of the – Peak measurement.

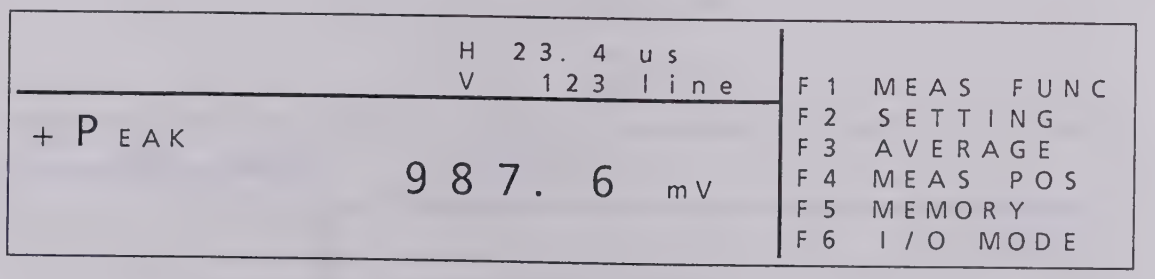


Figure 4-16 An example display of the + Peak measurement

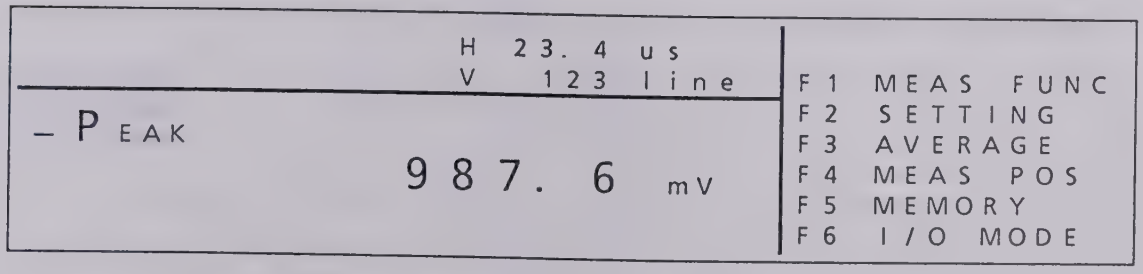
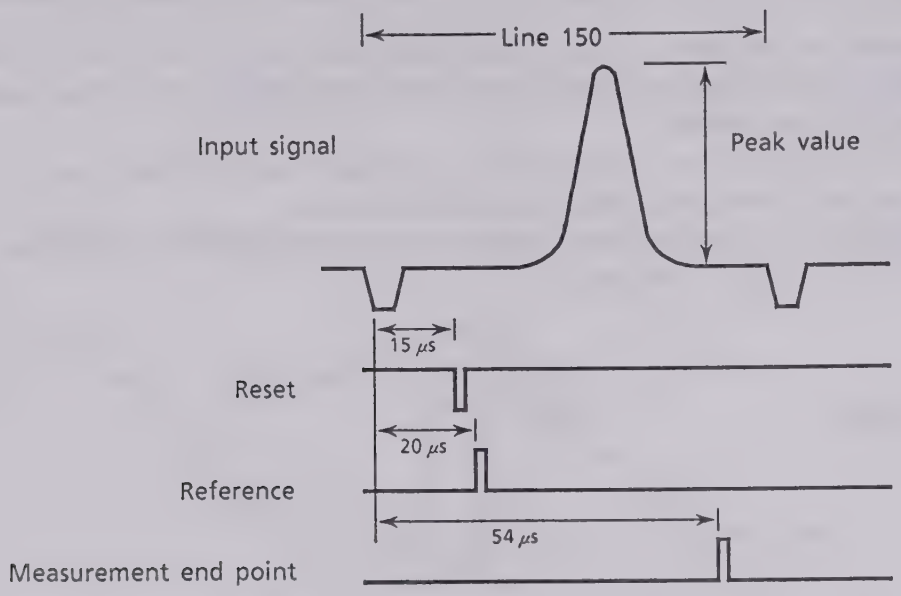


Figure 4-17 An example display of the – Peak measurement

Example 4-18) [+ Peak measurement] To measure the + peak value of a positive pulse.



H 23.4 us V 123 line	F1 MEAS FUNC F2 SETTING F3 AVERAGE F4 MEAS POS F5 MEMORY F6 I/O MODE
+ PEAK 987.6 mV	

⇩

F4 [ ]

⇩

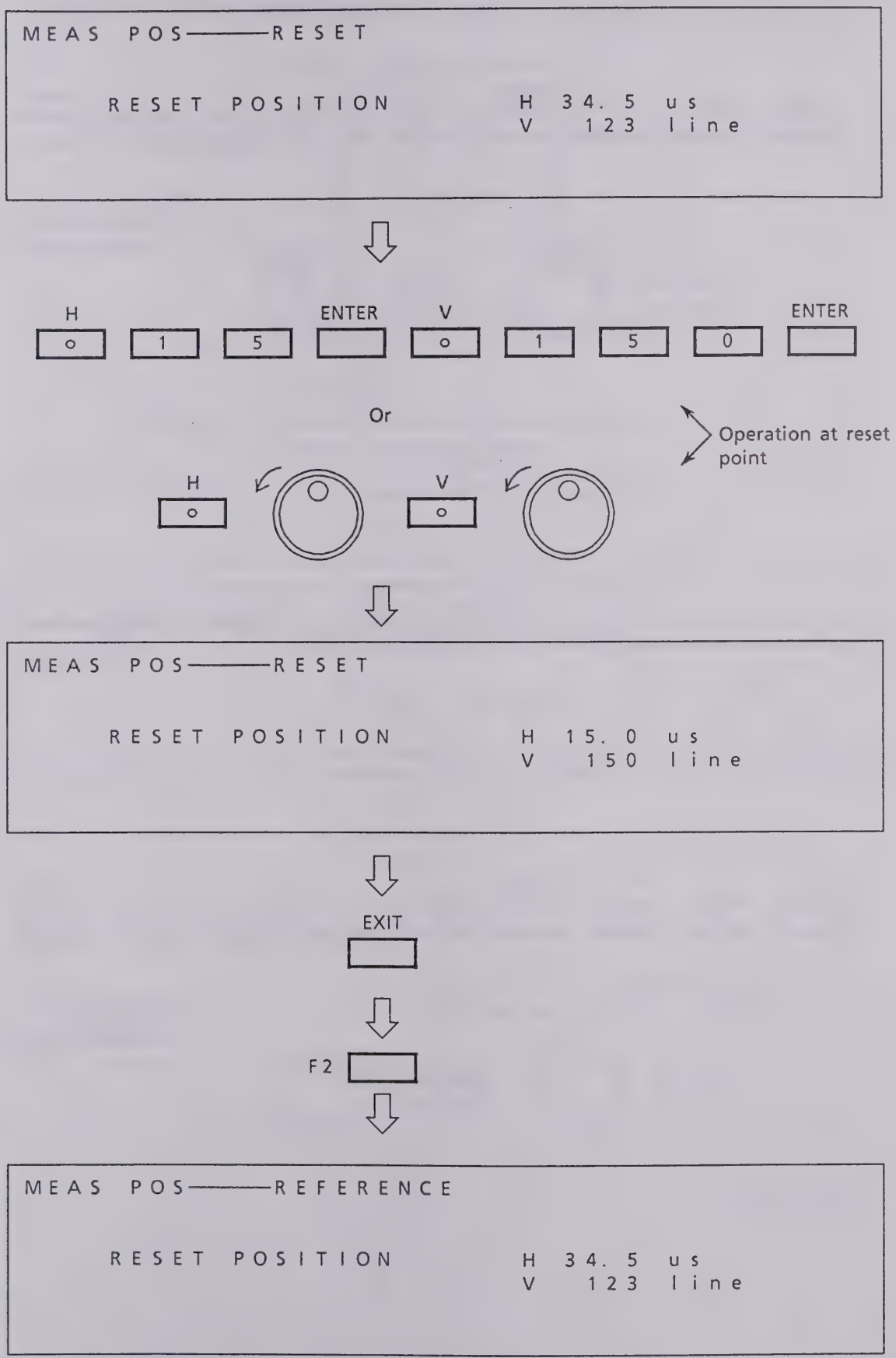
H 23.4 us V 123 line	MEAS POS F1 RESET F2 REFERENCE
+ PEAK 987.6 mV	

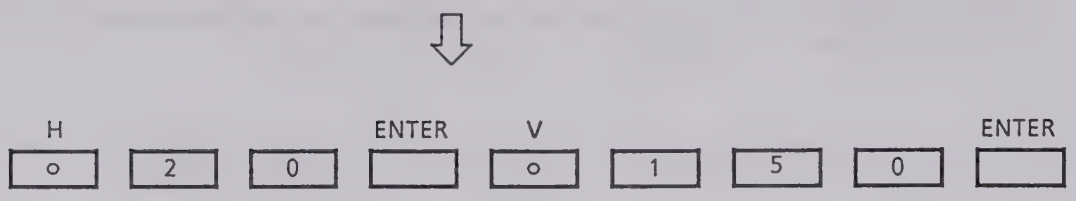
MEAS position data are to be displayed here.

⇩

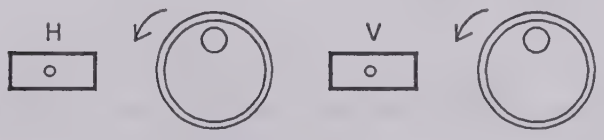
F1 [ ]

⇩


MEAS POS———RESET
RESET POSITION
H 34.5 us
V 123 line
H
0
1
5
ENTER
V
0
1
5
0
ENTER
Or
H
V
Operation at reset point
MEAS POS———RESET
RESET POSITION
H 15.0 us
V 150 line
EXIT
F2
MEAS POS———REFERENCE
RESET POSITION
H 34.5 us
V 123 line

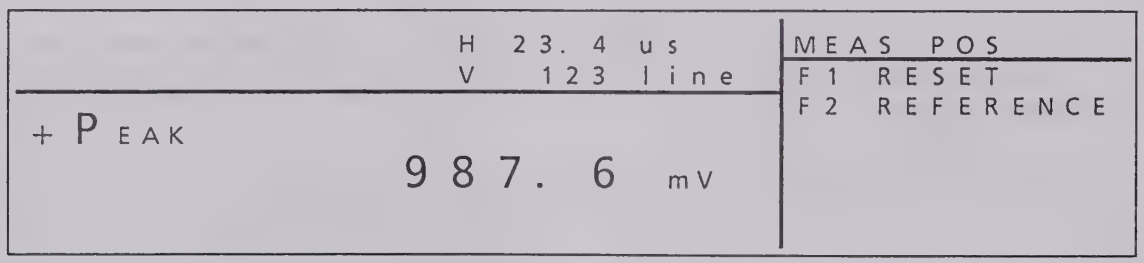


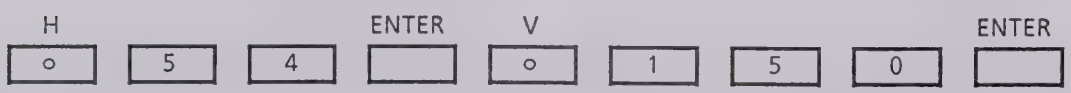
Or



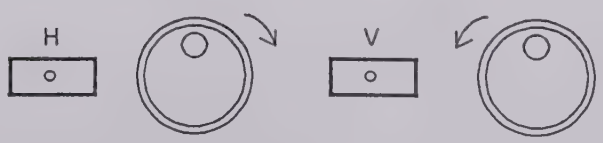
Operation at reference point

EXIT



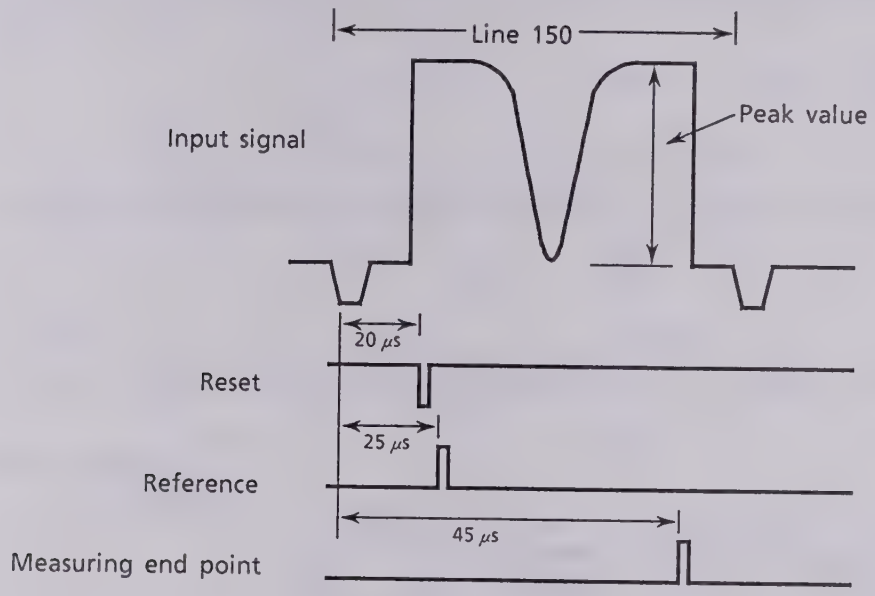


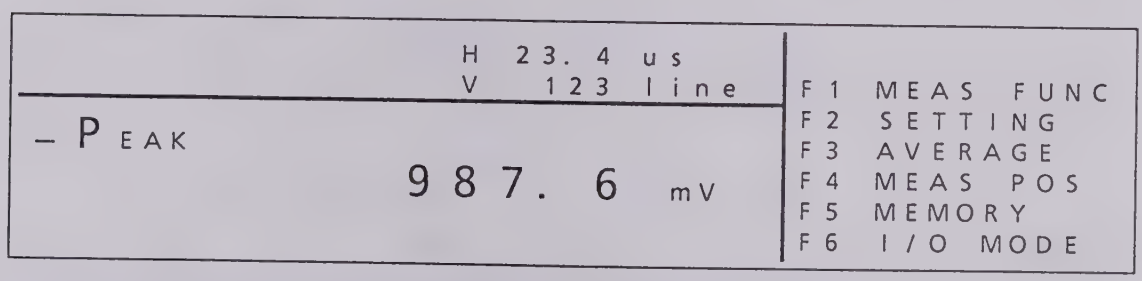
Or

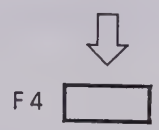


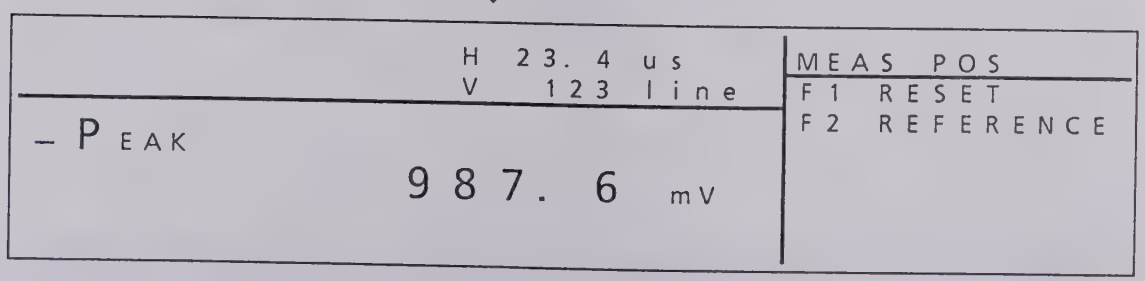
Operation at measurement end point

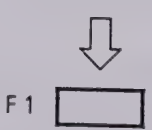
Example 4-19) [– Peak measurement] To measure the – Peak value of the negative pulse.



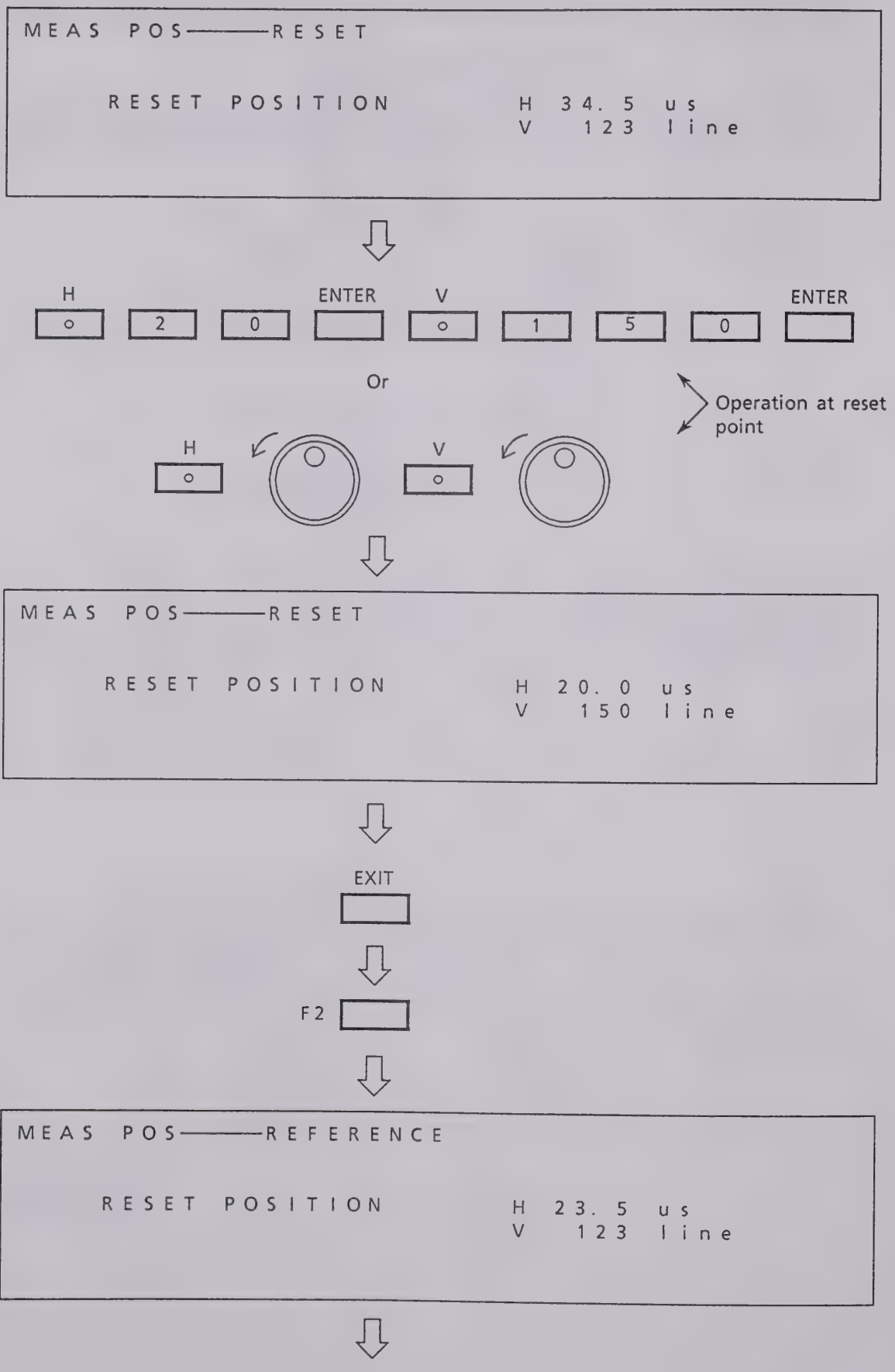


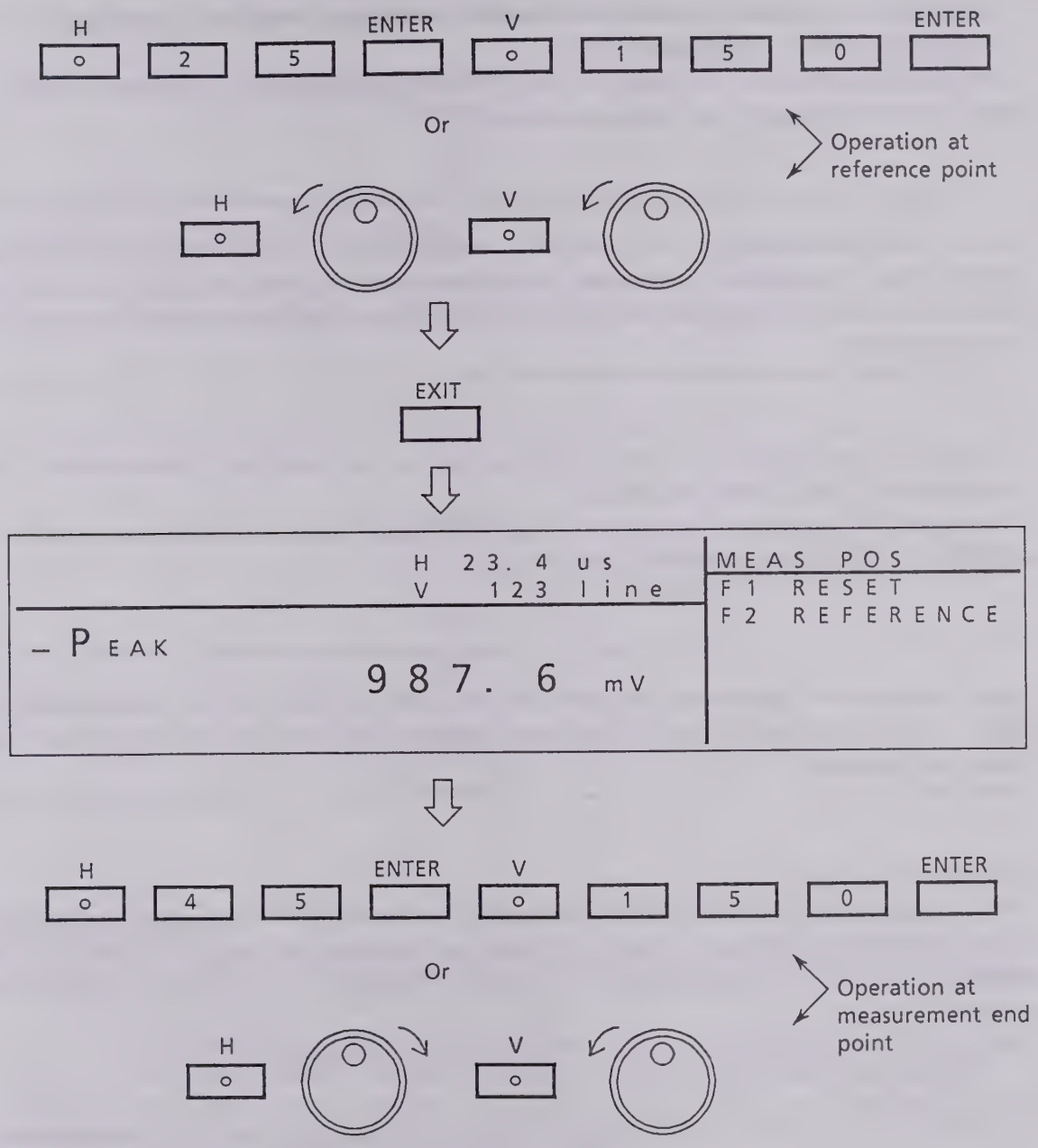






MEAS POS data are to be displayed here.


MEAS POS——RESET
RESET POSITION
H 34.5 us
V 123 line
H
2
0
ENTER
V
1
5
0
ENTER
Or
Operation at reset point
H
V
MEAS POS——RESET
RESET POSITION
H 20.0 us
V 150 line
EXIT
F2
MEAS POS——REFERENCE
RESET POSITION
H 23.5 us
V 123 line



Note

1. The numeric value at the end point of measurement must be set larger than that at the reset point ; otherwise, peak detection is to be performed all the period to the next field preventing an accurate measurement.
2. Set 100 μs or less for the period between the reset point and the end point of measurement; otherwise, proper measurement cannot be expected.
3. Reliable measurement result cannot be obtained unless there exist higher and lower levels with reference to the level at the reset position.

(4) Determining the number of times of summation average for Peak-Peak measurement, + Peak measurement, and – Peak measurement

The operation procedure is as same as that for the video levels and phase measurement. See paragraph 4-9 "Video levels and phase measurement".

Note

To sum up a consecutive lines, the reset point, reference point, and measuring end point must be on a line. If summation is executed on a consecutive lines with the above three not on a line, the reference and measurement end points are automatically placed on the line where the reset point exists.

(5) Registering and deleting of the measuring points of Peak-Peak measurement, + Peak measurement, and – Peak measurement

The operation procedure is as same as that for the video levels and phase measurement. See paragraph 4-9 "Video levels and phase measurement".

Note

Upon completion of registration, displayed on the color monitor is only the measurement end point. This is to prevent the points from being unidentifiable when two or more measurement points are registered.

(6) AC Peak measurement

This measurement is performed with the required reset point and measurement point internally provided, while the Peak-Peak, + Peak, and -Peak measurements are performed upon the timing information from the video signal applied. The period between the reset position and measuring end point is 100 μs.

Figure 4-18 shows an example display of the AC Peak measurement on the LCD.

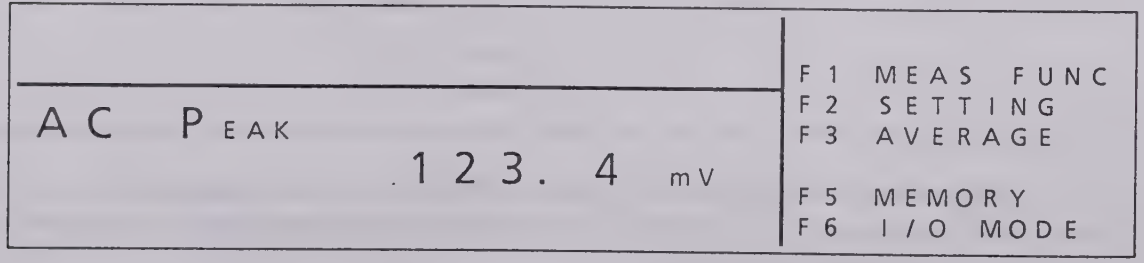
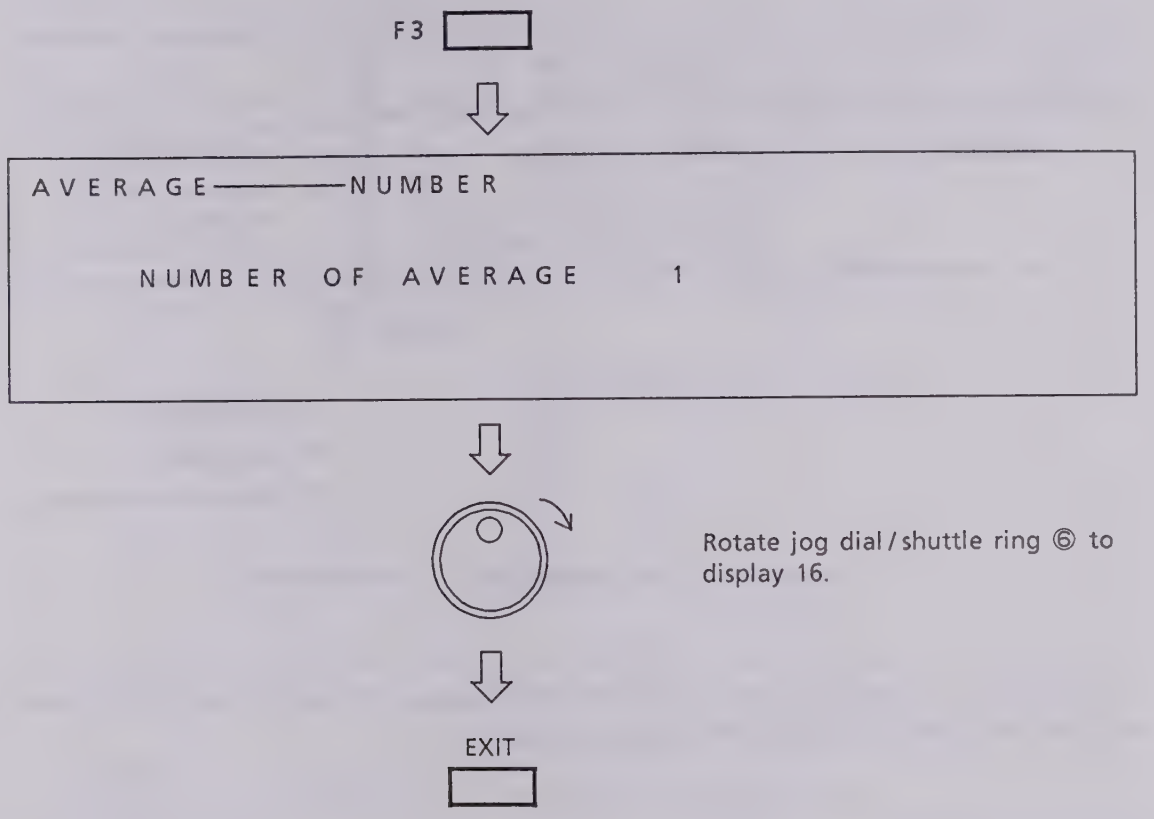


Figure 4-18 An example display of AC Peak measurement

The only operation required for the AC Peak measurement is the determination of the number of times of averaging.

Example 4-20) To set the number of times of summation average to 16.



4-11 ERROR MESSAGE

To apply video signal for proper measurement, the following conditions must be satisfied :

① The sync level stays within 0.15 to 0.6 Vp-p.

② The burst level stays within 0.15 to 0.6 Vp-p.

③ The subcarrier frequency stays within ± 150 Hz with respect to the rated value.

Note that some measurement items need not satisfy all of ① to ③ to be satisfied. See Table 4-3 Measurement items and conditions they need not satisfy.

Table 4-3 Measurement items and conditions they need not satisfy

	Y &C	Y	Peak-Peak	+ Peak	– Peak	AC Peak
① Sync level						×
② Burst level		×	×	×	×	×
③ Subcarrier frequency		×	×	×	×	×

× — Not required

Figure 4-19 shows the error ,message in the Y & C measurement

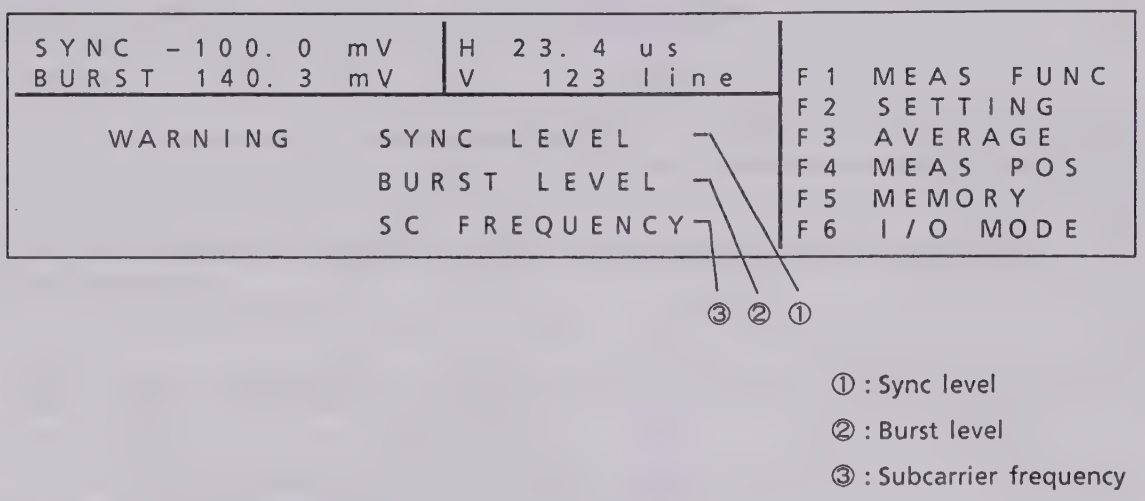


Figure 4-19 Error message in Y & C measurement

Figure 4-19 is a display where all of ① to ③ are shown. If only ① Sync signal level fails to satisfy the condition, SYNC LEVEL alone appears on screen.

4-12 OUTPUT SIGNALS

(1) Video signal

This is a signal applied in which markers indicating the measuring point is inserted. Connect the signal to the color monitor, and the desired measuring point is easy determined.

See paragraph 4-9 "Video levels and phase measurement" for the operation using this signal.

(2) Peak signal

The peak signal includes the timing signals (① RESET, ② SAMPLE, ③ S/H) and the analog signal (④ PEAK) of which peak has been detected.

- ① RESET ..... The start point of the desired period of the peak value to be obtained.
- ② SAMPLE ..... The end point of the desired period of the peak value to be obtained.
- ③ S/H ..... The desired point for reference.
- ④ PEAK ..... Peak detection signal.

Shown in Figure 4-20 is the peak signal when the peak value of the positive pulse is measured in the + Peak measurement.

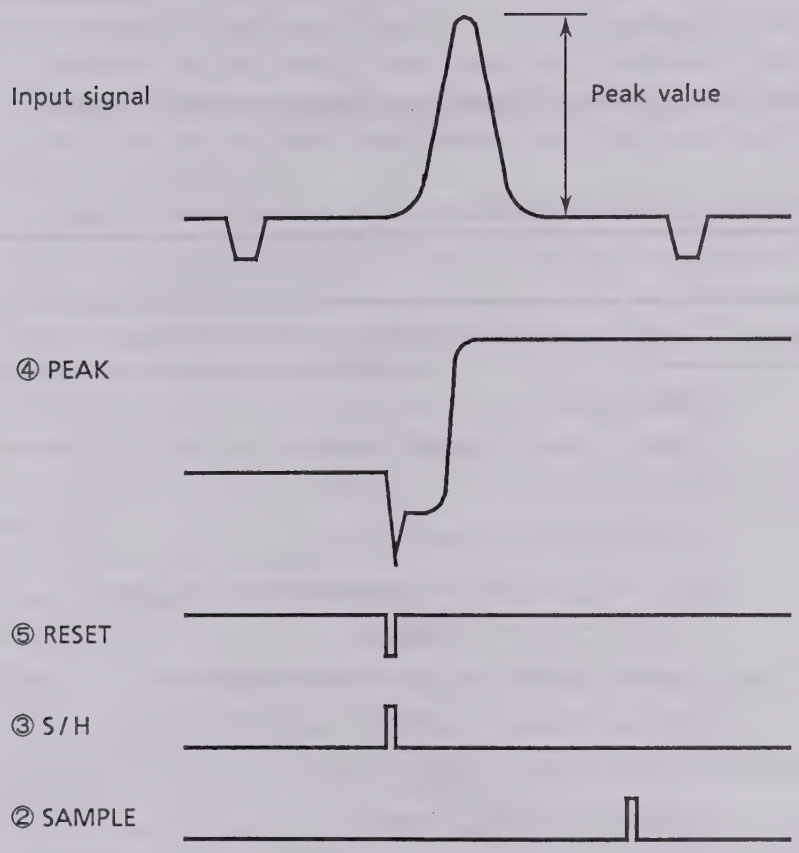


Figure 4-20 Positive Peak measurement of a positive pulse

Note

The peak detection signal (④ Peak) is output with positive polarity in the Peak-Peak and + Peak measurements, and with negative polarity in the – Peak.

4-13 ASSORTED PRESET MEMORY

The assorted preset memory stores up to 32 sets of conditions, such as system and input connector status, specified according to each operation procedures. The stored sets of conditions can be recalled at a time as required.

(1) Given in Table 4-4 are the conditions storable in the associated preset memory

Table 4-4 Conditions storable in the associated preset memory

Item	Setup conditions
Measurement functions	Y & C, Y, Peak-Peak, + Peak, – Peak, AC Peak
TV system	NTSC, PAL
Input connector	FRONT, REAR 1, REAR 2, REAR Y / C
Input impedance	75 Ω, HI-Z
Sync polarity	SYNC NEGATIVE, SYNC POSITIVE
Sync type	INT, EXT, Sync signal input impedance 75 Ω, HI-Z
Sample mode	1 FIELD, 2 FIELDS, 4 FIELDS
Measuring range (mV)	570 mV, 620 mV, 670 mV, 730 mV, 800 mV
	890 mV, 1000 mV, 1140 mV, 1300 mV, 1600 mV
(IRE / NTSC)	79.8 IRE, 86.8 IRE, 93.8 IRE, 102.2 IRE, 112.0 IRE, 124.6 IRE, 140.0 IRE,
	159.6 IRE, 182.0 IRE, 224.0 IRE
(IRE / PAL)	57.0 IRE, 62.0 IRE, 67.0 IRE, 73.0 IRE, 80.0 IRE, 89.0 IRE, 100.0 IRE,
	114.0 IRE, 130.0 IRE, 160.0 IRE
Offset (mV)	– 300 to 720 mV
(IRE / NTSC)	– 39.0 to 100.8 IRE
(IRE / PAL)	– 30.0 to 70.0 IRE
Summation average	Number of times of summation average 1, 2, 4, 8, 16, 32, 64
	Summation average line numbers 1, 2, 4, 8, 16, 32, 64
Measuring point	Measuring point H / V
	Sync point, burst point, PEDESTAL measuring point
	Reset point H / V, Reference point H / V
Selecting H / V	H / V
External control output	
Port 1	0 to 255
Port 2	0 to 255

(2) Memory address

The 32 sets of the preset memory are given memory addresses 00 to 31 for management.

(3) Displaying the preset memory menu screen

Select "F5 MEMORY" on the initial menu screen and press the F5 key to display the preset memory menu screen. If a screen other than the initial menu is being displayed, press the EXIT key to return the screen to the initial menu display and then press the F5 key. The operation procedure is shown in example 4-21.

The preset memory menu display and the keys defined are to be used as follows:

① Address display field
Displays the address of the current preset memory.

② Defines the F1 key as the STORE key.
Used for storing operation or for setting start / end addresses.

③ Defines the F2 key as the RECALL key
Used for direct recall operation or for specifying the group for sequential recall operation.

④ Defines the F3 key as the UP key
Used for sequential recall operation.

⑤ Defines the F4 key as the DOWN key
Used for sequential recall operation.

⑥ Defines the F5 key as the CLEAR key
Used for sequential recall operation.

⑦ Defines the F6 key as the AUTO SEQ key.
Used for executing and halting the auto sequence operation.

Example 4-21) Preset memory screen display

Initial menu screen

SYNC -280.5 mV BURST 276.7 mV	H 32.4 us V 150 line	
LUMI 538.4 mV CHROMA 633.8 mV 60.1 deg		F1 MEAS FUNC F2 SETTING F3 AVERAGE F4 MEAS POS F5 MEMORY F6 I/O MODE

Preset memory menu screen

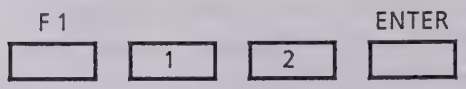
SYNC -280.5 mV BURST 276.7 mV	H 32.4 us V 150 line	MEMORY 10	— ①
		F1 STORE	— ②
		F2 RECALL	— ③
LUMI 538.4 mV		F3 UP	— ④
CHROMA 633.8 mV		F4 DOWN	— ⑤
60.1 deg		F5 CLEAR	— ⑥
		F6 AUTO SEQ	— ⑦

① Address display
② F1 : STORE key definition
③ F2 : RECALL key definition
④ F3 : UP key definition
⑤ F4 : DOWN key definition
⑥ F5 : CLEAR key definition
⑦ F6 : AUTO SEQ key definition

(4) Store operation

After completing the required setup, display the preset memory menu on screen and then press the STORE key (F1 key). Now the F1 STORE display field appears in reverse video indicating the memory address is ready to accept storing data. Enter the required memory address with the numeric keys and press the ENTER key to execute storing data in the preset memory.

Example 4-22) To store the current setup state in memory address 12

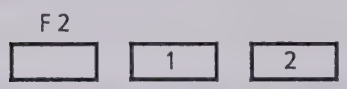


Pressing the ENTER key without entering any address stores the data in the address currently displayed.

(3) Direct recall operation

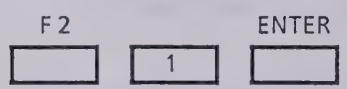
Display the preset memory menu screen and press the RECALL key (F2 key). Now the F2 RECALL display field is displayed in reverse video indicating the memory address is ready to accept storing data. Using the numeric keys to enter the two-digit memory address recalls the corresponding preset memory.

Example 4-23) To recall memory address 12



Preset memory addresses 00 to 09 can also be recalled by entering only one digit.

Example 4-24) To recall memory address 1



Pressing the ENTER key without entering any address stores the data in the address currently displayed.

(6) Sequential recall operation

(a) General description

The data between the desired start and end addresses can be sequentially recalled just by pressing one key.

Given in the following paragraphs are the procedures for setting the start and end addresses and the sequential recalling.

(b) Setting start and end addresses

Display the preset memory menu screen and press the STORE key (F1 key). Now the F1 STORE display is displayed in reverse video indicating the memory address is ready to accept storing data. Use the numeric keys to enter a point (.), a two-digit memory address, point (.), and a two-digit end address, and press the ENTER key to set the start and end addresses.

Example 4-25) To set 01 for the start address, and 23 for the end address

Once the start and end addresses are set, a decimal point appears at the lower digit of the address display field. Canceling the set start and end address is as shown in example 4-26. This operation produces the result identical to that when 00 is set for the start address and 31 for the end address.

Example 4-26) Canceling start and end addresses

Note

Of the set start and end address values, the analyzer takes the smaller one as the start address. Therefore, setting as :

and executing the sequential recall operation recalls addresses in the sequence of :

$01 \rightarrow 02 \rightarrow \cdots \rightarrow 22 \rightarrow 23$

(c) Sequential recall operation

With the preset memory menu screen displayed, press the UP key (F3 key), DOWN key (F4 key), and CLEAR key (F5 key) to sequentially recall the preset memory.

Pressing the UP key (F3 key) recalls the address next to that currently displayed. When the end address is currently displayed, pressing the UP key (F3 key) recalls the start address.

Pressing the DOWN key (F4 key) recalls the address before the one currently displayed. When the start address is currently displayed, pressing the DOWN key (F4 key) recalls the end address.

Pressing the CLEAR key (F5 key) recalls the start address. When the start and end addresses have been canceled, the CLEAR key (F5 key) recalls address 00.

(7) Grouping for sequential recalling

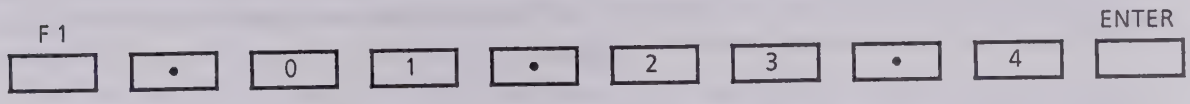
(a) General

The preset memory can be divided into ten groups and sequential recalling is allowed to be performed on the desired group specified. Described below are the operation procedures for grouping, group specification for sequential recalling, and canceling the sequential recalling in a group.

(b) Grouping

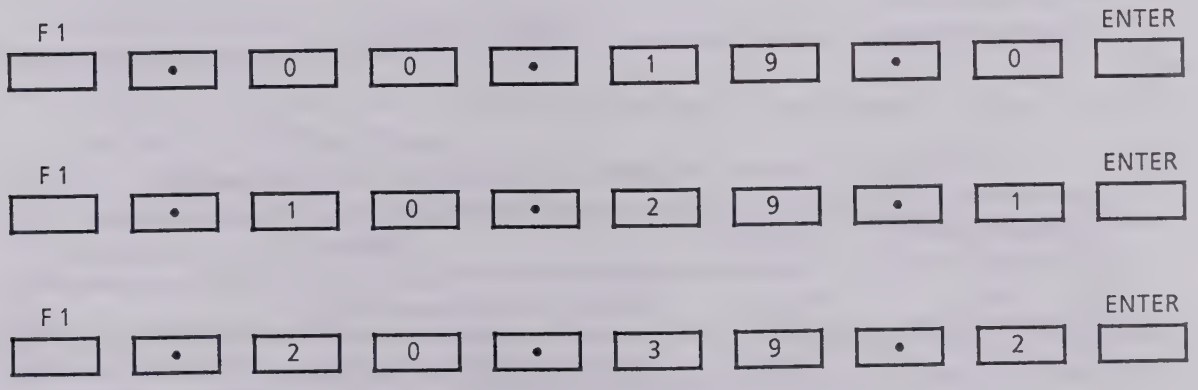
Display the preset memory menu on screen and press the STORE key (F1 key). Now the F1 STORE display appears in reverse video indicating the analyzer is ready to accept memory addresses. Use the numeric keys to enter point (.), two-digit start address, point (.), two-digit end address, point (.), and one-digit group number. Then press the ENTER key to set the start and end addresses and the group number.

Example 4-27) Name the addresses from start address 01 to end address 23 as group 4.



Two or more groups can include the same addresses.

Example 4-28) Specifying three groups including the same addresses.



(c) Specifying a group for sequential recalling

Display the preset memory menu on screen and press the RECALL key (F2 key). Use the numeric keys to enter point (.) and one-digit group number, and then press the ENTER key. Now the group for sequential recalling is specified.

Example 4-29) Specifying group 0

Once the group is specified, a decimal point appears at the lower digit of the address display field.

(d) Canceling the sequential recalling in a group

The start and end addresses can be canceled as shown in Figure 4-30. This operation produces the result identical to that when 00 is set for the start address and 31 for the end address. The divided groups remain in memory.

Example 4-30) Canceling the sequential recalling in a group

(8) GP-IB program code

The storing and direct recalling operation of the preset memory can be controlled via the GP-IB.

Table 4-5 The GP-IB program code relating to the preset memory

Header code	Data code	Description
RC	00 to 31	Recalls from addresses 00 to 31.
ST	00 to 31	Stores to addresses 00 to 31.

4-14 AUTO SEQUENCE OF THE ASSORTED PRESET MEMORY

(1) General

The auto sequence function sequentially recalls the data stored in the associated preset memory at a desired interval time. The basic operation of the auto sequence includes setting of the modes for auto sequencing, setting of the interval time, and starting and halting of the sequencing.

(2) Setting the mode for auto sequencing

The following four operation modes are available for auto sequencing :

Mode	
Repeat up :	Performs auto sequencing repetitively from the start to end addresses.
Single up :	Performs auto sequencing only once from the start to end addresses.
Repeat down :	Performs auto sequencing repetitively from the end to start addresses.
Single down :	Performs auto sequencing only once from the end to start addresses.

(a) Setting the mode for auto sequencing

Pressing the F6 key with the initial menu on screen displays the I/O mode menu on screen. If the display other than the initial menu is on screen, press the EXIT key to return the display to the initial menu screen and then press the F6 key.

Pressing the F3 key with the I/O mode menu on screen displays the auto sequence mode setup screen. Example 4-31 shows an operation example.

The auto sequence mode setup screen contains the following :

① Mode display
Displays the mode for auto sequence.

② Address display
Displays the address of the preset memory.

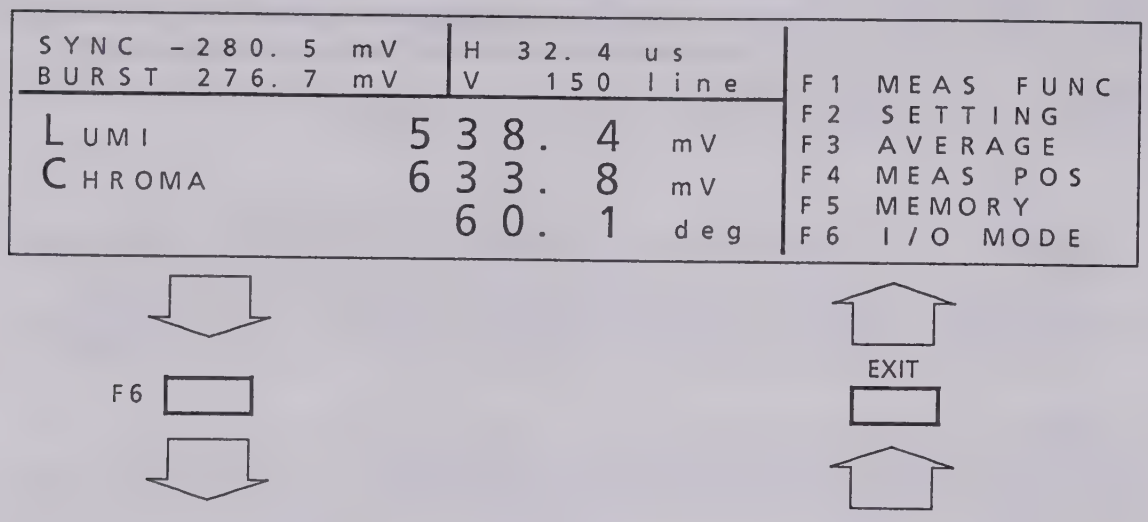
③ Interval time display
Displays the interval time in the auto sequence of the memory address currently displayed in the address display.

④ Print address display
Indicates the print specification status of the memory address currently displayed in the address display.

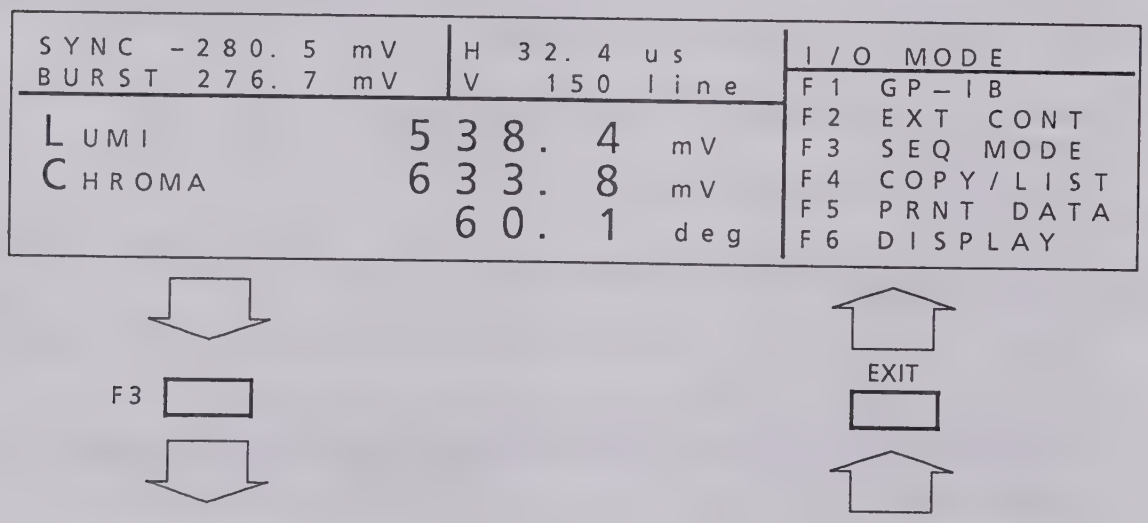
Pressing the NEXT key with the auto sequence mode setup on screen sequentially displays the mode, address, interval time, and print address display fields in reverse video. The item in reverse video can be set.

Example 4-31) To display the auto sequence setup screens

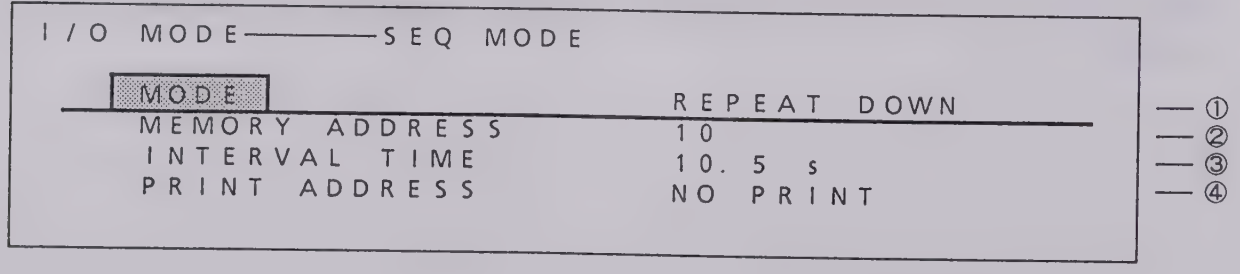
Initial menu screen



I/O mode menu screen



Auto sequence mode setup screen



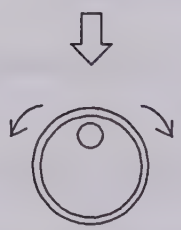
① : Mode display
② : Address display
③ : Interval time display
④ : Print address display

(b) Setting operation

Display the auto sequence mode setup screen and press the NEXT key to select the mode display field. Now the auto sequence mode is acceptable. Use the jog dial to set the desired auto sequence mode.

Example 4-32) To select SINGLE UP for the auto sequence mode

```
I/O MODE————SEQ MODE

 MODE                        REPEAT DOWN
 MEMORY ADDRESS              10
 INTERVAL TIME               10.5 s
 PRINT ADDRESS               NO PRINT
```



Rotate jog dial ⑥ to set the auto sequence mode.

```
I/O MODE————SEQ MODE

 MODE                        SINGLE UP
 MEMORY ADDRESS              10
 INTERVAL TIME               10.5 s
 PRINT ADDRESS               NO PRINT
```

(3) Interval time

In the auto sequence operation, an interval time from recalling a memory to recalling another can be set. The time may be different for each memory address.

(a) Displaying the auto sequence mode setup screen

Press the F6 key on the initial menu screen to display the I/O mode menu screen. If the display other than the initial menu is currently on screen, press the EXIT key to bring the initial menu on screen and then press the F6 key. Example 4-33) shows an example operation.

Pressing the F3 key with the I/O mode menu on screen displays the auto sequence mode setup screen.

The auto sequence mode setup screen contains the following:

① Mode display
Displays the mode for auto sequence.

② Address display
Displays the address of the preset memory.

③ Interval time display
Displays the interval time in the auto sequence of the memory address currently displayed in the address display.

④ Print address display
Indicates the print specification status of the memory address currently displayed in the address display.

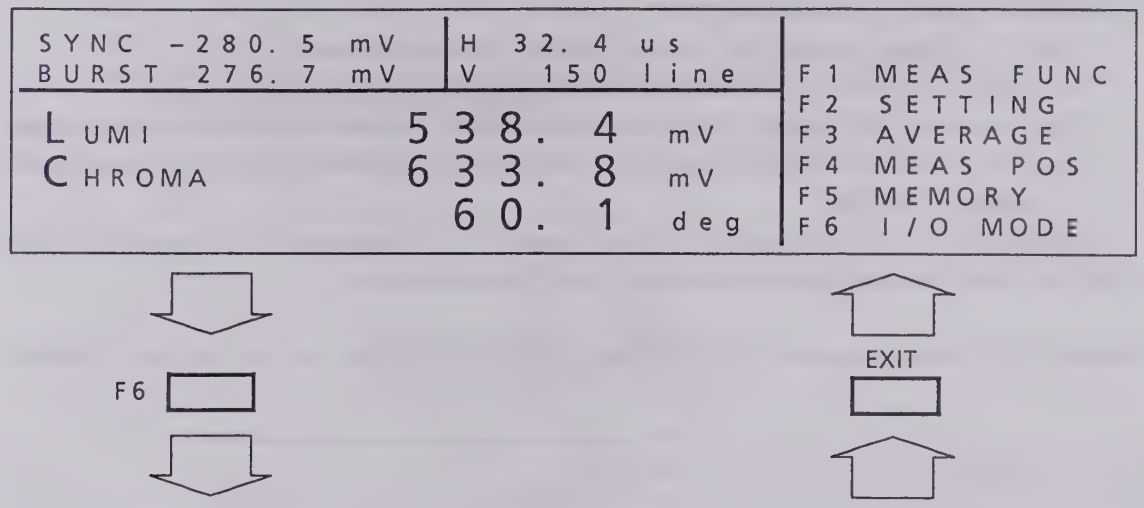
Pressing the NEXT key with the auto sequence mode setup screen displayed sequentially displays the mode, address, interval time, and print address display fields in reverse video. The item currently displayed in reverse video can be set.

The interval time is displayed in the interval time display field in second(s). The setting range and the resolution are as follows:

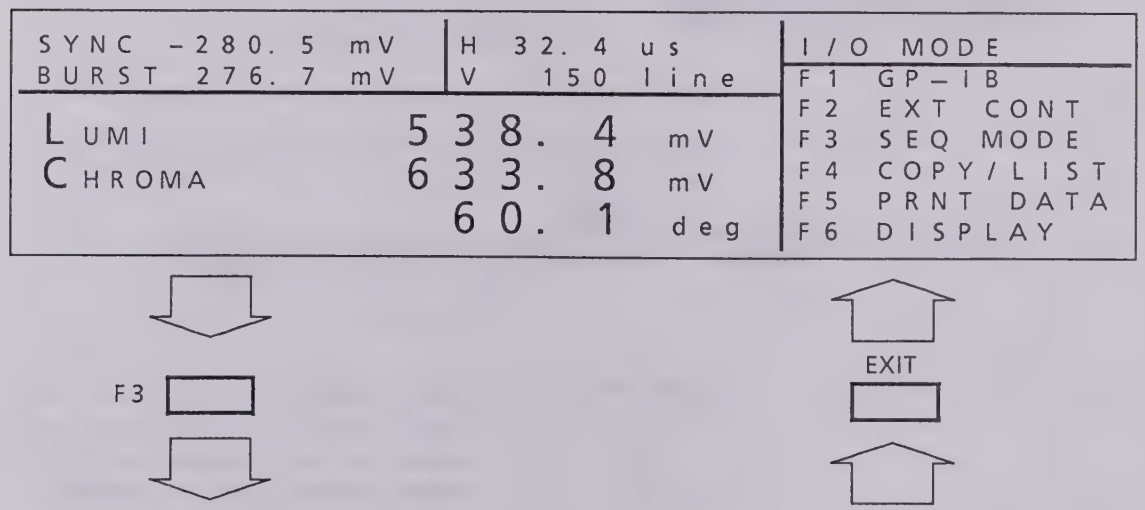
0.1 to 99.9 s / 0.1 s

Example 4-33) The auto sequence mode setup display.

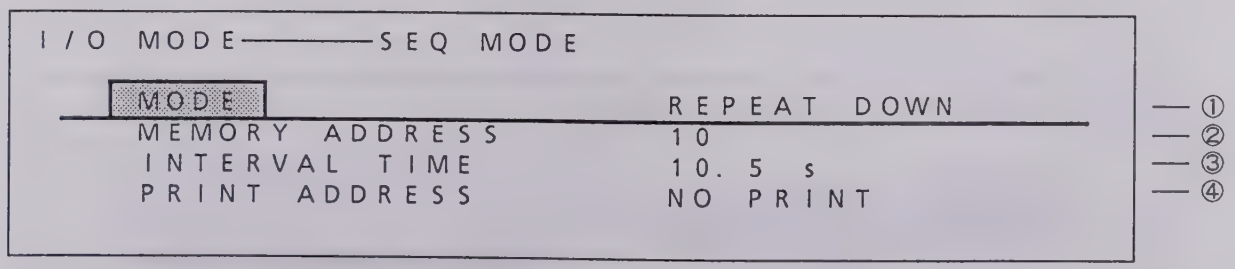
Initial menu screen



I/O mode menu screen



Auto sequence mode setup screen



① : Mode display
② : Address display
③ : Interval time display
④ : Print address display

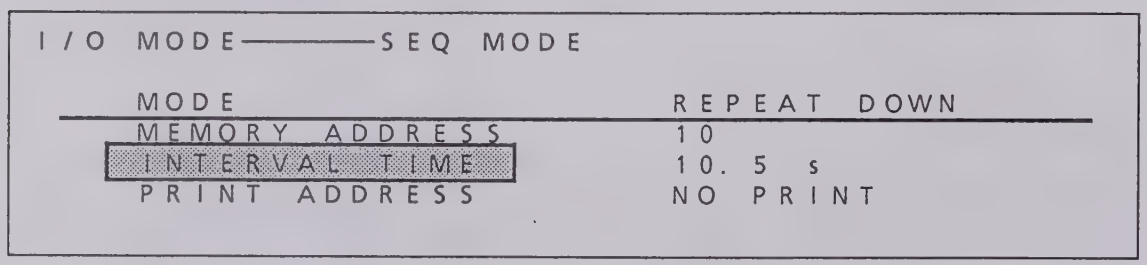
(b) Setting operation

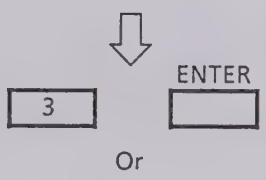
Display the auto sequence mode setup screen and press the NEXT key to select the interval time display field. Now the interval time can be set. The following four setting procedures are available for setting the interval time :

- To set the interval time of the memory address currently displayed.
- To set the interval time of a desired address.
- To set at a time the interval time of all the addresses between the two desired addresses.
- To set at a time the interval time of all the adresses between start and end addresses of the squential recalling.

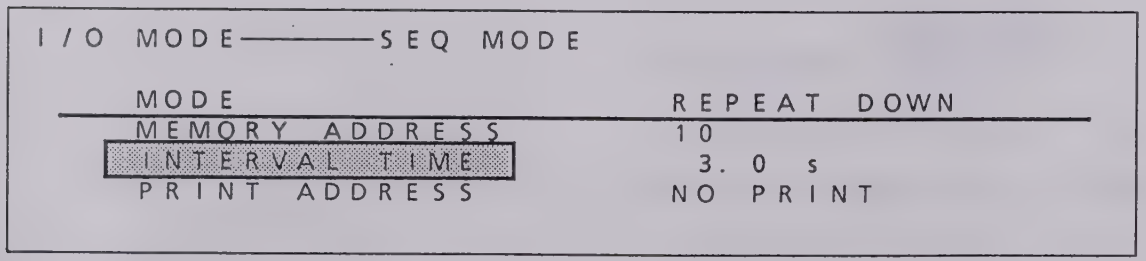
Examples for each of the above are given below. In the examples, it is assumed that 00 is set for the preset memory start address and 19 for the end address.

Example 4-34) To set 3 seconds for the interval time of the memory address currently displayed.

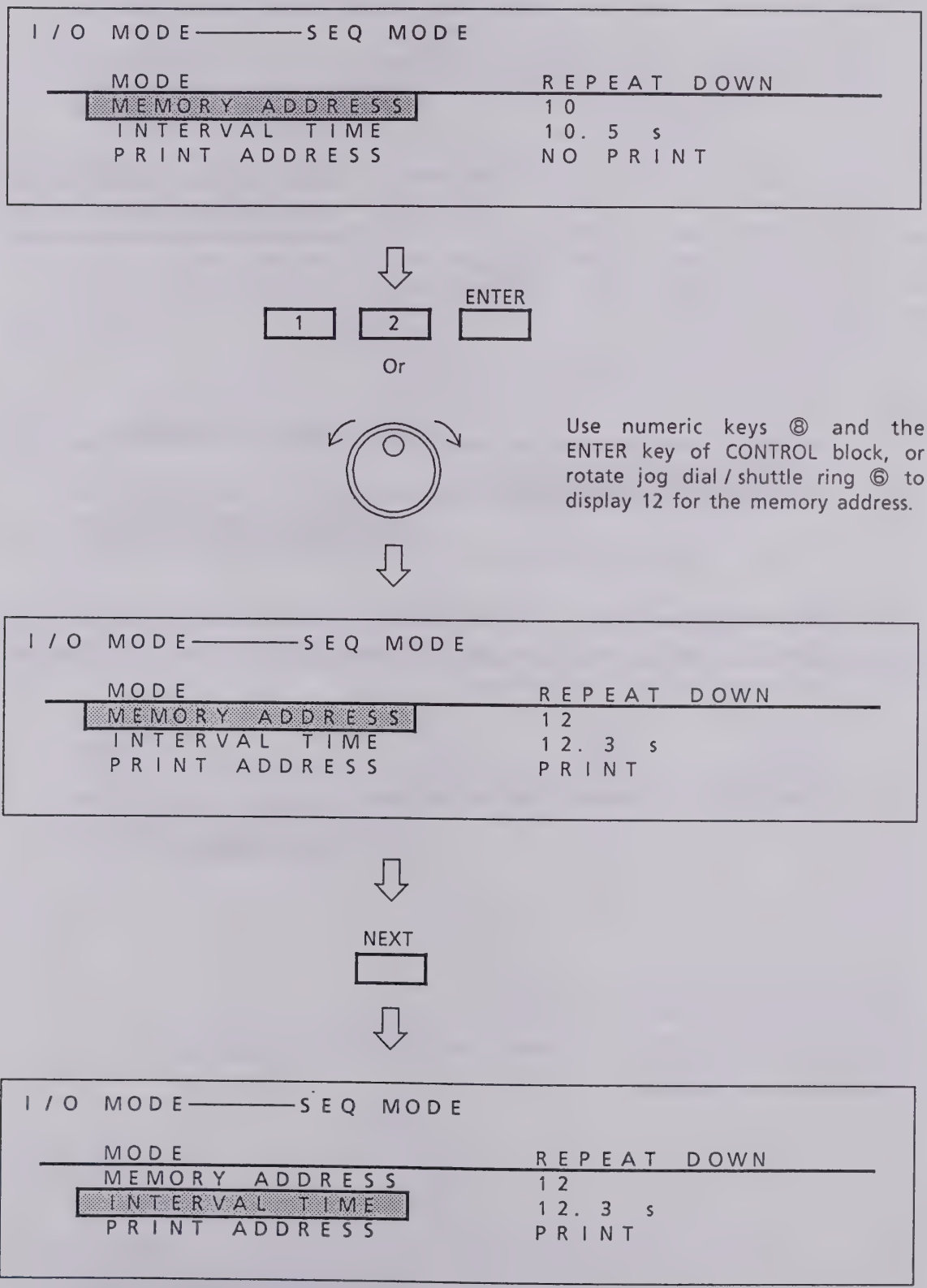


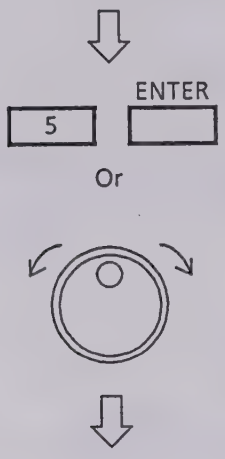


Use numeric keys ⑧ and the ENTER key of CONTROL block, or rotate jog dial / shuttle ring ⑥ to set the interval time to 3 seconds.

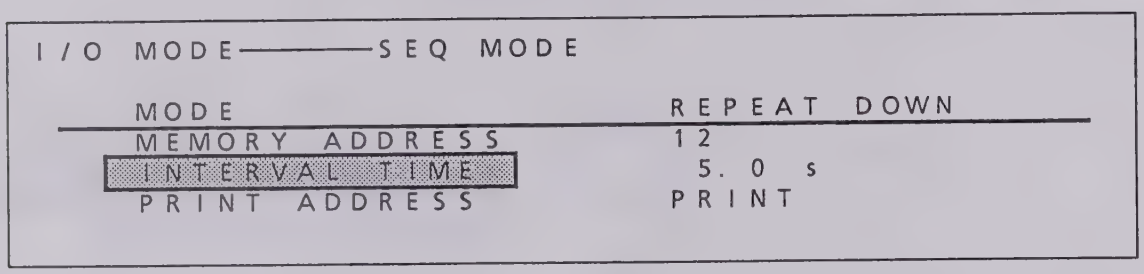


Example 4-35) To set five seconds for the interval time of memory address 12.

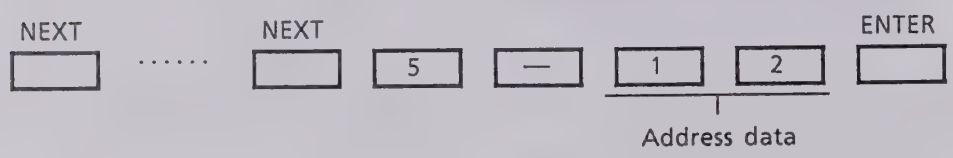




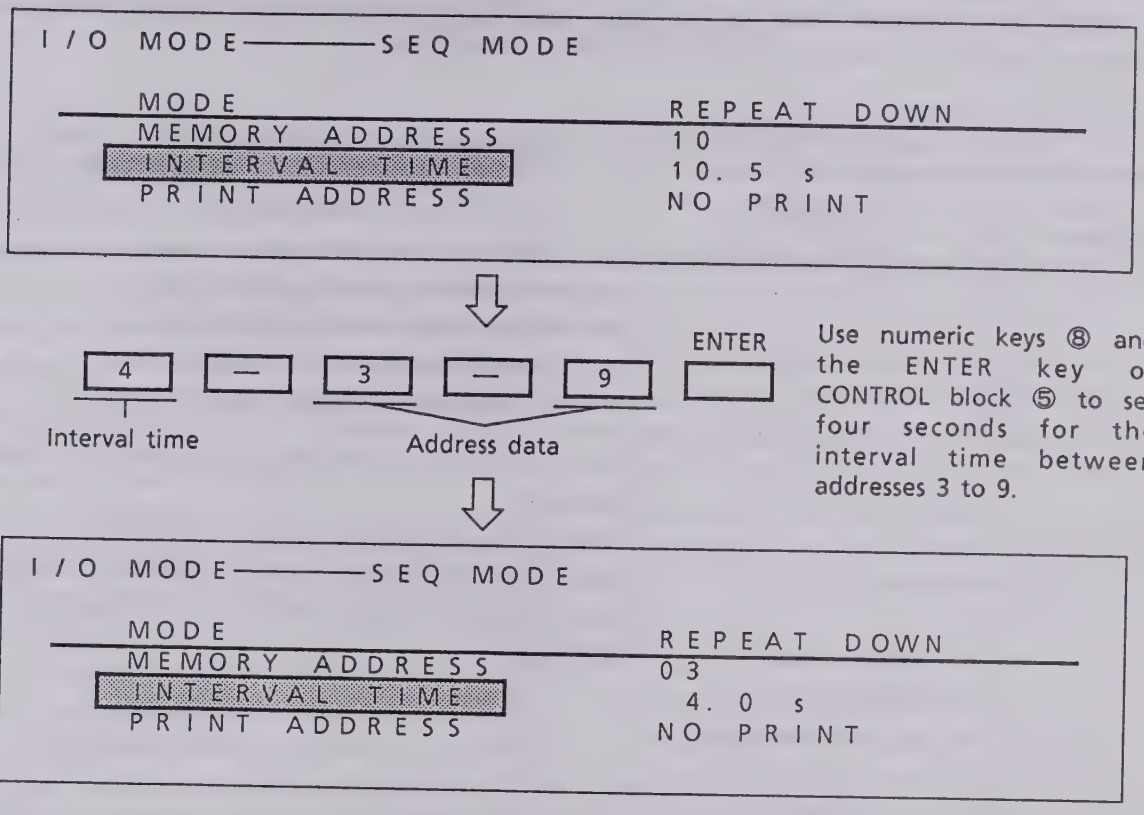
Use numeric keys ⑧ and the ENTER key of CONTROL block, or rotate jog dial / shuttle ring ⑥ to display 5.0 s for the interval time.



To set the interval time of a desired address, it is also possible to press the NEXT key to display the interval time display field in reverse video, and then to set the time using the numeric keys and the ENTER key.

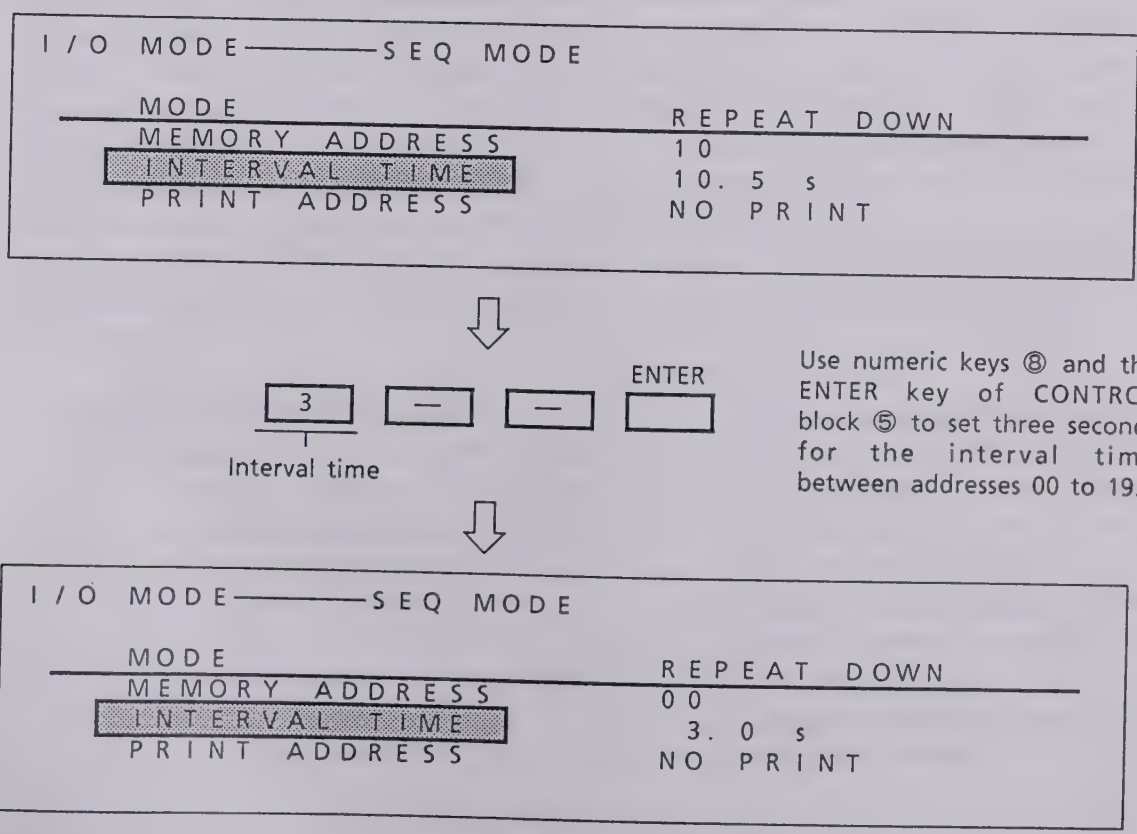


Example 4-36) Set four seconds for the interval time of memory addresses 3 to 9.



Use numeric keys ⑧ and the ENTER key of CONTROL block ⑤ to set four seconds for the interval time between addresses 3 to 9.

Example 4-37) To set three seconds for the interval time of all addresses from the start to the end.



Use numeric keys ⑧ and the ENTER key of CONTROL block ⑤ to set three seconds for the interval time between addresses 00 to 19.

(4) GP-IB program code

Setting the operation mode of the auto sequence function and the interval time can be controlled through the GP-IB.

Table 4-6 The GP-IB program codes relating to auto sequence

Header code	Data code	Description
AS	0	Sets the operation mode to REPEAT UP.
	1	Sets the operation mode to SINGLE UP.
	2	Sets the operation mode to REPEAT DOWN.
	3	Sets the operation mode to SINGLE DOWN.
NT	t	Sets t (s) for the interval time of the address currently displayed.
	$t-a_1$	Sets t (s) for the interval time of address a_1.
	$t-a_2-a_3$	Sets t (s) for the interval time of addresses a_2 to a_3.
	t– –	Set t (s) for the interval time of the start to end addresses.
	t : Interval time 0.10 to 99.9	
	a_1, a_2, a_3 : Addresses 00 to 31 ($a_2 < a_3$)	

SECTION V
GP-IB OVERVIEW

5-1 GENERAL

The GP-IB (General Purpose Interface Bus) has been known as a special bus structure defined by the IEEE Standard 488. The overall purpose of the interface system is to provide an effective communication link over which messages are carried in an unambiguous way among a group of interconnected devices.

5-2 DEVICES IN THE SYSTEM

The communication link requires three basic functional elements to organize and manage the flow of information to be exchanged among devices : (1) A device acting as a listener, (2) a device acting as a talker, and (3) a device acting as a controller.

A talker sends data to listeners on the bus, a listener receives data from the talker on the bus, and a controller controls the activity of the bus. Many devices are both a talker and listener, but there are devices that can be fixed to act as a talker only or a listener only with the "Only" mode of operation. Besides, there are devices that act inherently as a listener only (e.g., a printer).

The controller is the only device capable of sending commands by which the activities on the bus are altered. The controller can pick out a specific device and instruct it to be a talker or listener.

5-3 MESSAGE PATHS AND BUS STRUCTURE

The GP-IB contains a set of sixteen signal lines used to carry all information, interface messages, and device dependent messages among interconnected devices. Figure 5-1 is a diagram of the interface connection and bus structure.

The bus structure is organized into three sets of signal lines:

(1) Data bus, 8 signal lines (DIO 1 ... 8)

(2) Handshake lines or data byte transfer control bus, 3 signal lines (DAV, NRFD and NDAC)

(3) Control lines or interface management bus, 5 signal lines (ATN, IFC, SRQ, REN and EOI)

The bus consists of a 24-line passive cable of which sixteen lines are used for signal lines described above and the remaining eight are used for ground connection. Since the bus has a negative logic convention, a less positive voltage level is referred to as TRUE (binary 1) and a more positive voltage level is FALSE (binary 0).

5-4 DATA LINES (DATA BUS)

The data lines carry message bytes in a bit-parallel byte-serial form, asynchronously, and generally in a bidirectional manner. These lines carry either data or command information, depending upon the condition of the ATN management line. Normally, a seven-bit ASCII code represents each byte of messages, leaving the eighth bit available for parity checking.

Commands are categorized into two groups, one Addressed Command Group effective only for listeners and another Universal Command Group effective for all devices. The following are typical commands with brief descriptions.

Addressed commands:

GTL Go To Local. Returns the listening device(s) to local front panel control.

SDC Selected Device Clear. Returns the listening device(s) to a predefined device-dependent state.

GET Group Execute Trigger. Causes the listening device(s) to perform a device-dependent action.

UNL Unlisten. Releases all listening devices from being listeners.

Universal commands:

LLO Local Lockout. Prevents the device operator from manually inhibiting remote program control.

DCL Device Clear. Sets the device to its initial conditions.

SPE Serial Poll* Enable. Places the device under serial poll mode.

SPD Serial Poll Disable. Releases the device from serial poll mode.

* Polling is a mean by which a controller can identify a device that needs interaction with it. The controller may poll devices for their operational condition one at a time, which is termed a serial poll, or as groups of devices simultaneously, which is termed a parallel

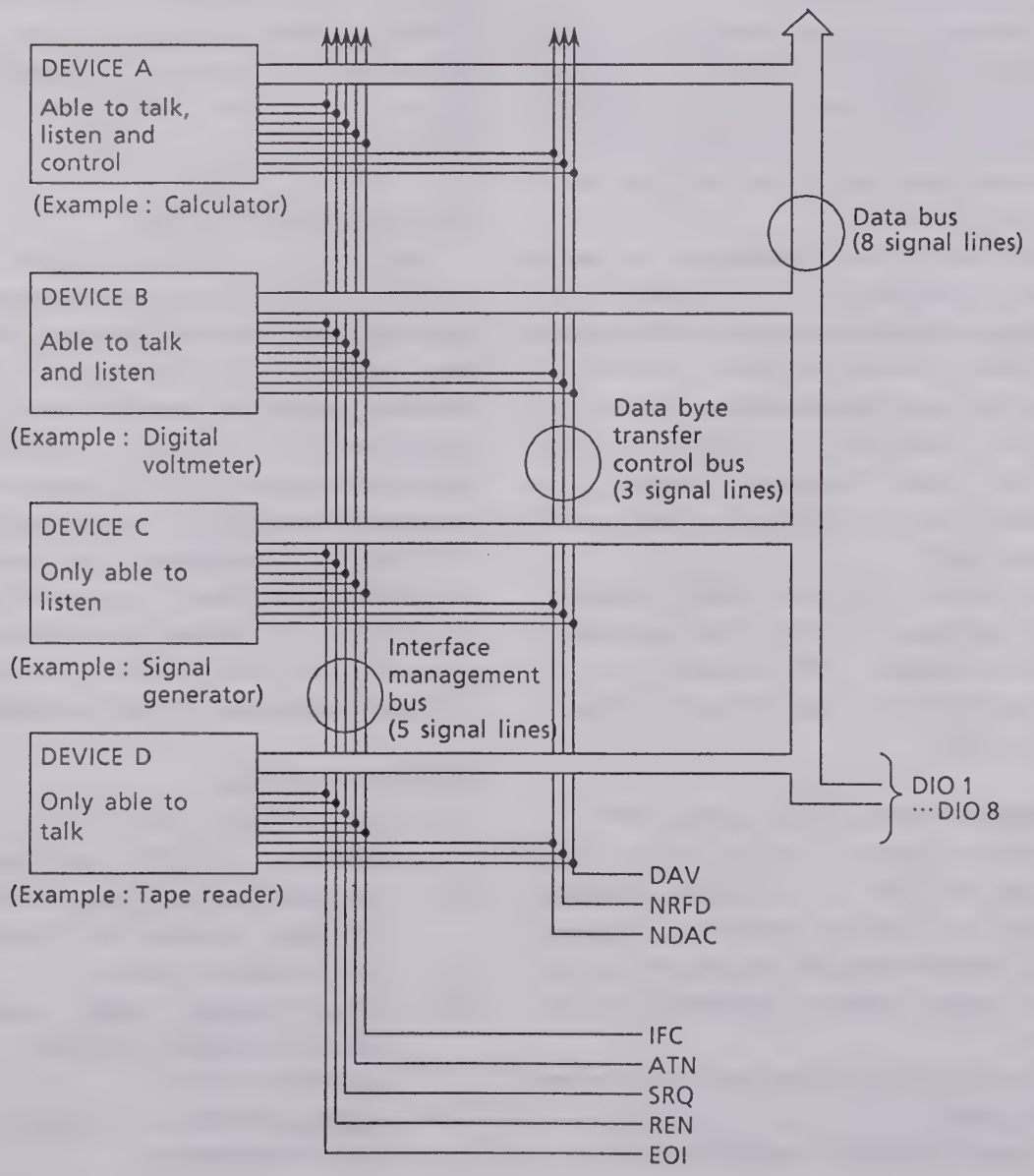


Figure 5-1 Interface connection and bus structure

The commands are sent from the controller when the ATN line is Low (TRUE). MLA (My Listen Address) and MTA (My Talk Address) are used to designate the devices as a listener or talker respectively.

Each device has a 5-bit address switch usually on the rear panel to be used for assigning an address. Using this address the device can respond to addressed commands.

5-5 HANDSHAKE LINES
(DATA BYTE TRANSFER CONTROL BUS)

A set of three interface signal lines (DAV, NRFD, and NDAC) operate in what is called a three-wire interlocked handshake process to transfer each data byte across the interface:

(1) DAV line (Data Valid) is used to indicate the condition (availability and validity) of information on the DIO signal lines.

(2) NRFD line (Not Ready for Data) is used to indicate the condition of readiness of device(s) to accept data.

(3) NDAC line (Not Data Accepted) is used to indicate the condition of acceptance of data by device(s).

The handshake process timing diagram is shown in Figure 5-2, and its flow diagram is shown in Figure 5-3.

Each byte of data transferred by the interface uses the handshake process between a source and acceptor. In a typical example, the source is a talker and the acceptor is a listener.

The talker waits for NRFD (all listeners become ready to receive) and, after receiving NRFD, it generates and sends a DAV. The listener receives data after receiving this DAV, releases NDAC when all data have been received, and releases NRFD when the device is ready to receive the next byte of data. This sequence allows consecutive data transfer. A wired-OR configuration in the NRFD and NDAC lines permit data transfer at the rate of the slowest device. This enables the data transfer rate of these lines to match that of the device, assuring accurate data transfer.

5-6 CONTROL LINES
(INTERFACE MANAGEMENT BUS)

Five interface signal lines are used to manage an orderly flow of information across the interface:

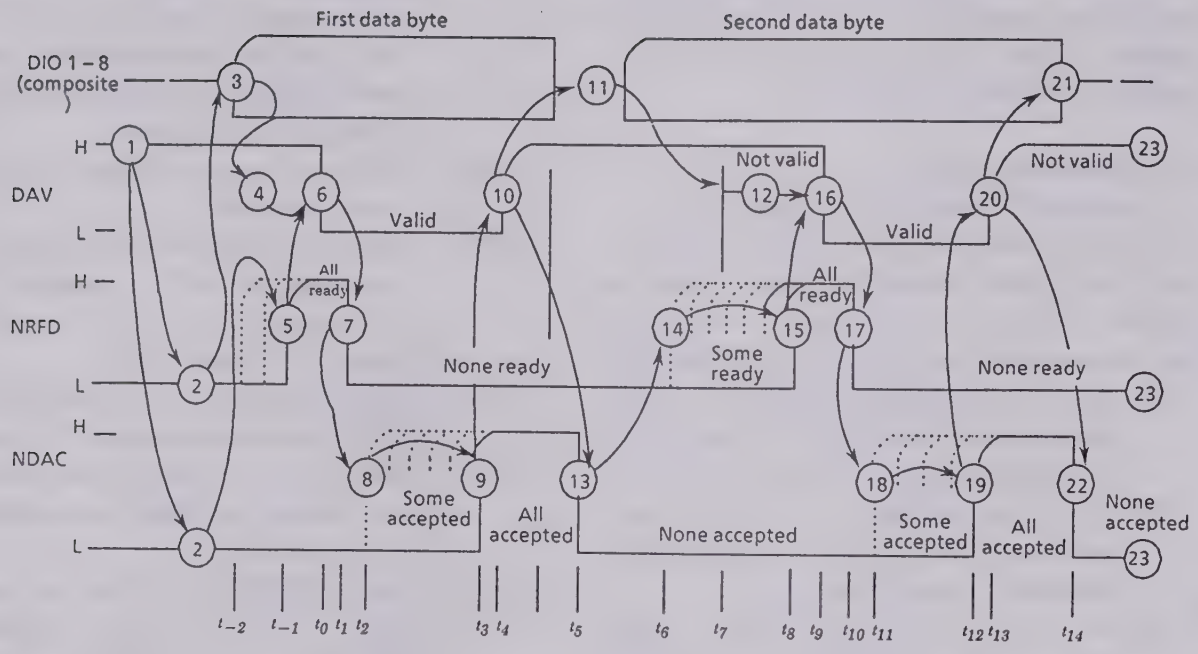
(1) ATN Attention. Identifies the information on the data bus.
Data can be sent when the ATN line is High, and the commands can be sent when it is Low.

(2) IFC Interface Clear. Initializes the bus to an idle state.

(3) SRQ Service Request. Indicates the need for attention and to request an interruption of the current sequence of events.

(4) REN Remote Enable. Places instruments under remote program control. When the REN line is Low, devices are made to be ready for operation in remote mode.

(5) EOI End or Identify. Indicates the end of a multiple byte transfer sequence or, in conjunction with ATN, to execute a polling sequence.



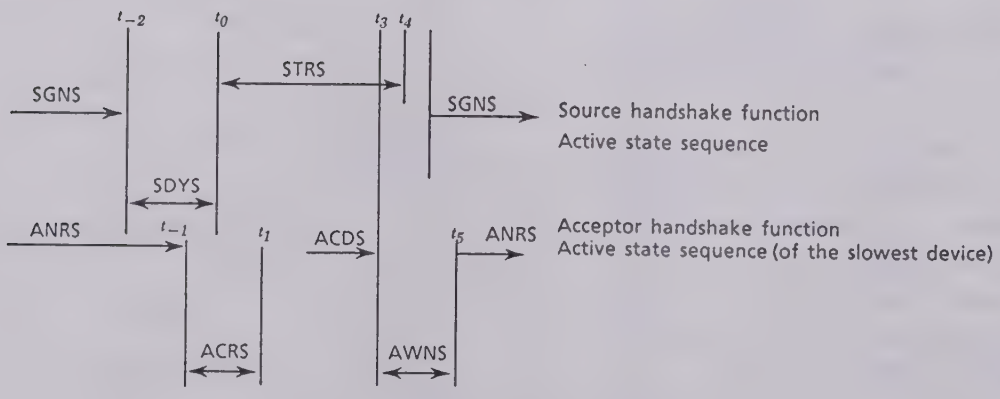


Figure 5-2 Handshake process timing diagram

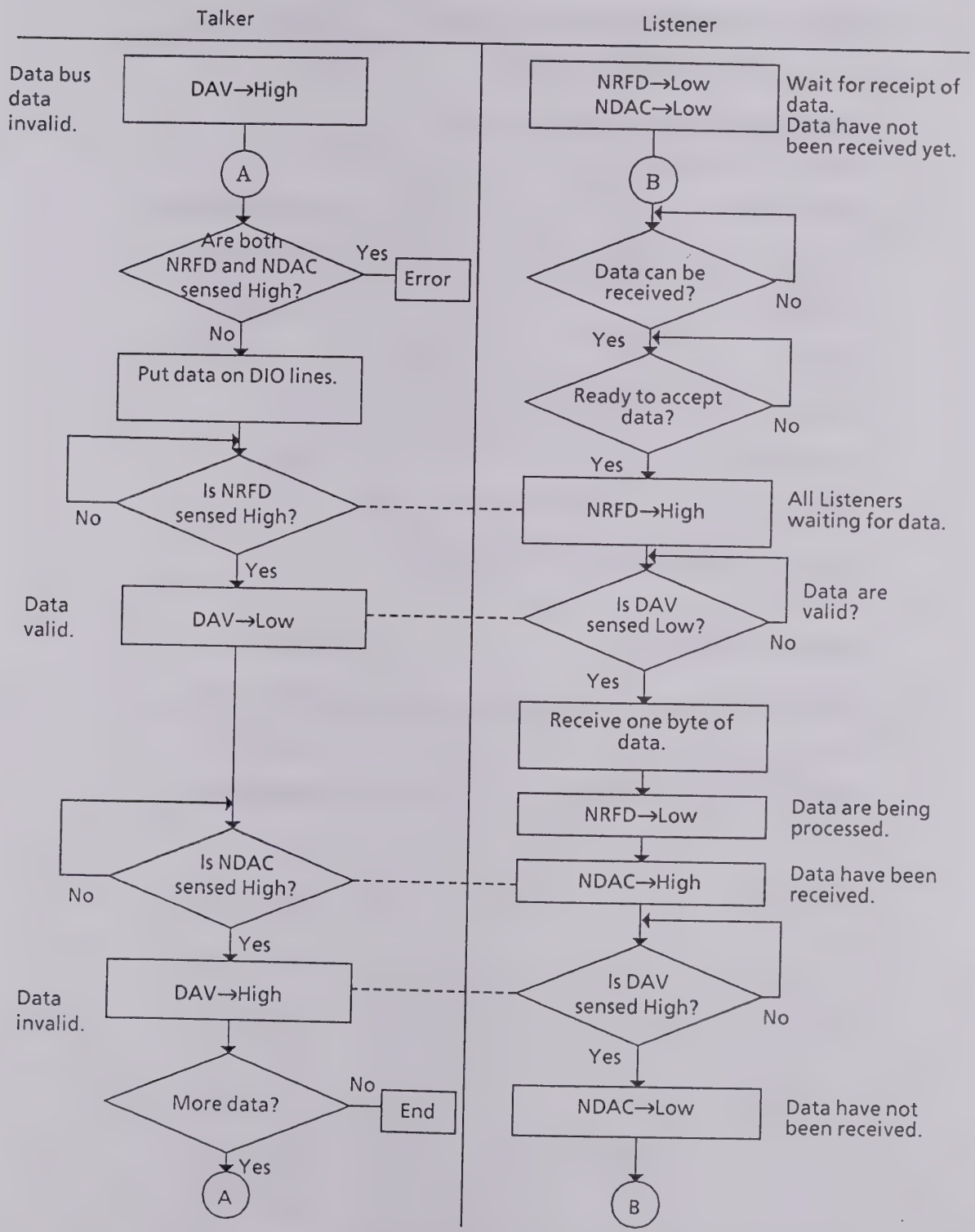


Figure 5-3 Handshake process flow diagram

5-7 MAJOR SPECIFICATIONS OF THE IEEE488, GP-IB

The maximum accumulative length of cable :	20 m
The maximum length between devices :	2 m
The maximum number of devices that can be connected, including controllers :	15
Transfer format:	3-wire handshaking
The maximum transfer rate :	1 M bytes / sec.
Data transfer :	8-bit parallel
Signal lines	
• Data lines (DIO 1 to DIO 8)	8 lines
• Control lines Handshaking lines (DAV, NRFD, NDAC) Interface management lines (ATN, REN, IFC, SRQ, EOI)	8 lines
• Signal / System ground	8 lines
Signal logic	Negative logic
• True : Level L	0.8 V or less
• False : Level H	2.0 V or more

Interface connector

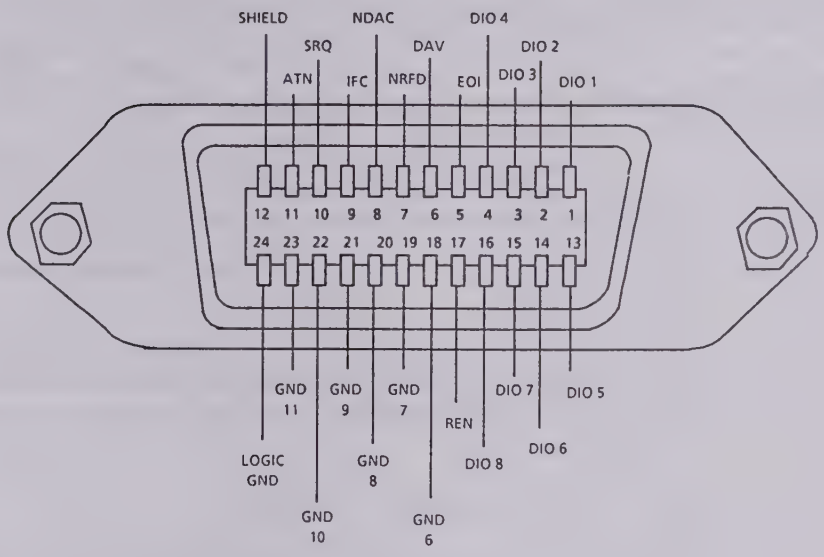


Table 5-1 Relationship between connector pin numbers and signal lines

Pin No.	IEC standard	IEEE standard	Pin No.	IEC standard	IEEE standard
1	DIO 1	DIO 1	14	DIO 5	DIO 6
2	DIO 2	DIO 2	15	DIO 6	DIO 7
3	DIO 3	DIO 3	16	DIO 7	DIO 8
4	DIO 4	DIO 4	17	DIO 8	REN
5	REN	EOI	18	Ground	Ground (6)
6	EOI	DAV	19	Ground (6)	Ground (7)
7	DAV	NRFD	20	Ground (7)	Ground (8)
8	NRFD	NDAC	21	Ground (8)	Ground (9)
9	NDAC	IFC	22	Ground (9)	Ground (10)
10	IFC	SRQ	23	Ground	Ground (11)
11	SRQ	ATN	24	Ground (11)	Logic Ground
12	ATN	Shield	25	Ground (12)	
13	Shield	DIO 5			

Note 1: Ground followed by parentheses indicates that the ground is for signal of pin number in parentheses.

Note 2: Ground of pin numbers 18 and 23 of the IEC standard may be used as a common logic ground.

5-8 CODE ASSIGNMENT OF COMMAND INFORMATION

Command information is the output from the controller when the ATN is Low.

Table 5-2 Code assignment of command information

Bits ② b_7 b_6 b_5					0 0 0	① MSG	0 0 1	MSG	0 1 0	MSG	0 1 1	MSG	1 0 0	MSG	1 1 0	MSG	1 0 1	MSG	1 1 1	MSG
b_4	b_3	b_2	b_1	Column→ Row ↓	0		1		2		3		4		5		6		7	
0	0	0	0	0	NUL		DLE		SP		0		@		P		`		p	
0	0	0	1	1	SOH	GTL	DC1	LLO	!		1		A		Q		a		q	
0	0	1	0	2	STX		DC2		"		2		B		R		b		r	
0	0	1	1	3	ETX		DC3		#		3		C		S		c		s	
0	1	0	0	4	EOT	SDC	DC4	DCL	$		4		D		T		d		t	
0	1	0	1	5	ENQ	PPC ③	NAK	PPU	%		5		E		U		e		u	
0	1	1	0	6	ACK		SYN		&		6		F		V		f		v	
0	1	1	1	7	BEL		ETB		'		7		G		W		g		w	
1	0	0	0	8	BS	GET	CAN	SPE	(		8		H		X		h		x	
1	0	0	1	9	HT	TCT	EM	SPD	)		9		I		Y		i		y	
1	0	1	0	10	LF		SUB		*		:		J		Z		j		z	
1	0	1	1	11	VT		ESC		+		;		K		[		k		{	
1	1	0	0	12	FF		FS		,		<		L		\		l		¦	
1	1	0	1	13	CR		GS		-		=		M		]		m		}	
1	1	1	0	14	SO		RS		.		>		N		^		n		~	
1	1	1	1	15	SI		US		/		?	UNL	O		_	UNT	o		DEL	

MLA assigned to device

MTA assigned to device

Meaning defined by PCG code

Meaning defined by PCG code

Addressed command group (ACG)

Universal command group (UCG)

Listen address group (LAG)

Talk address group (TAG)

Primary command group (PCG)

Secondary command group (SCG)

Notes: ① MSG means an interface message.

② b_1 = DIO 1 ..... b_7 = DIO 7. DIO 8 is not used.

③ Requires secondary command.

SECTION VI
GP-IB INTERFACE

6-1 GENERAL

The following functions are made available on the VP-8450A through the use of the GP-IB.

(1) The remote control of the analyzer's setup state by the program codes sent out from the controller. (Listener function)

(2) Sending out to the controller the analyzer's setup state or the read data of the EXT CONTROL I/O (see paragraph 7-10 for details). (Talker function)

(3) Memory sync and memory copy. (Talk only/listen only)

Given in the following paragraphs are the detailed descriptions of the analyzer's functions and operation procedures relating to the GP-IB.

6-2 GP-IB INTERFACE CAPABILITIES

The VP-8450A has the basic listener/talker, listen only/talk only, and remote/local functions. Table 6-1 shows the interface function of the analyzer.

Table 6-1 Interface function

Feature	Code	Description
Source handshake	SH 1	Complete capability
Acceptor handshake	AH 1	Complete capability
Talker	T 7	Basic talker, talker clear by MLA, talk only
Listener	L 3	Basic listener, listener clear by MTA, listen only
Service request	SR 1	Complete capability
Remote/local	RL 1	Complete capability
Parallel poll	PP 0	No capability
Device clear	DC 1	Complete capability
Device trigger	DT 1	Complete capability
Controller	C 0	No controller capability

6-3 DEVICE ADDRESS SETTING

The GP-IB device address is set by panel key operation.

(1) Displaying the GP-IB mode setup screen

Press the F6 key with the initial menu on screen to display the I/O mode menu. If the display other than the initial menu is currently on screen, press the EXIT key to bring the initial menu on screen and then press the F6 key.

Pressing the F1 key with the I/O mode menu on screen displays the GP-IB mode setup screen. An example operation is given in example 6-1.

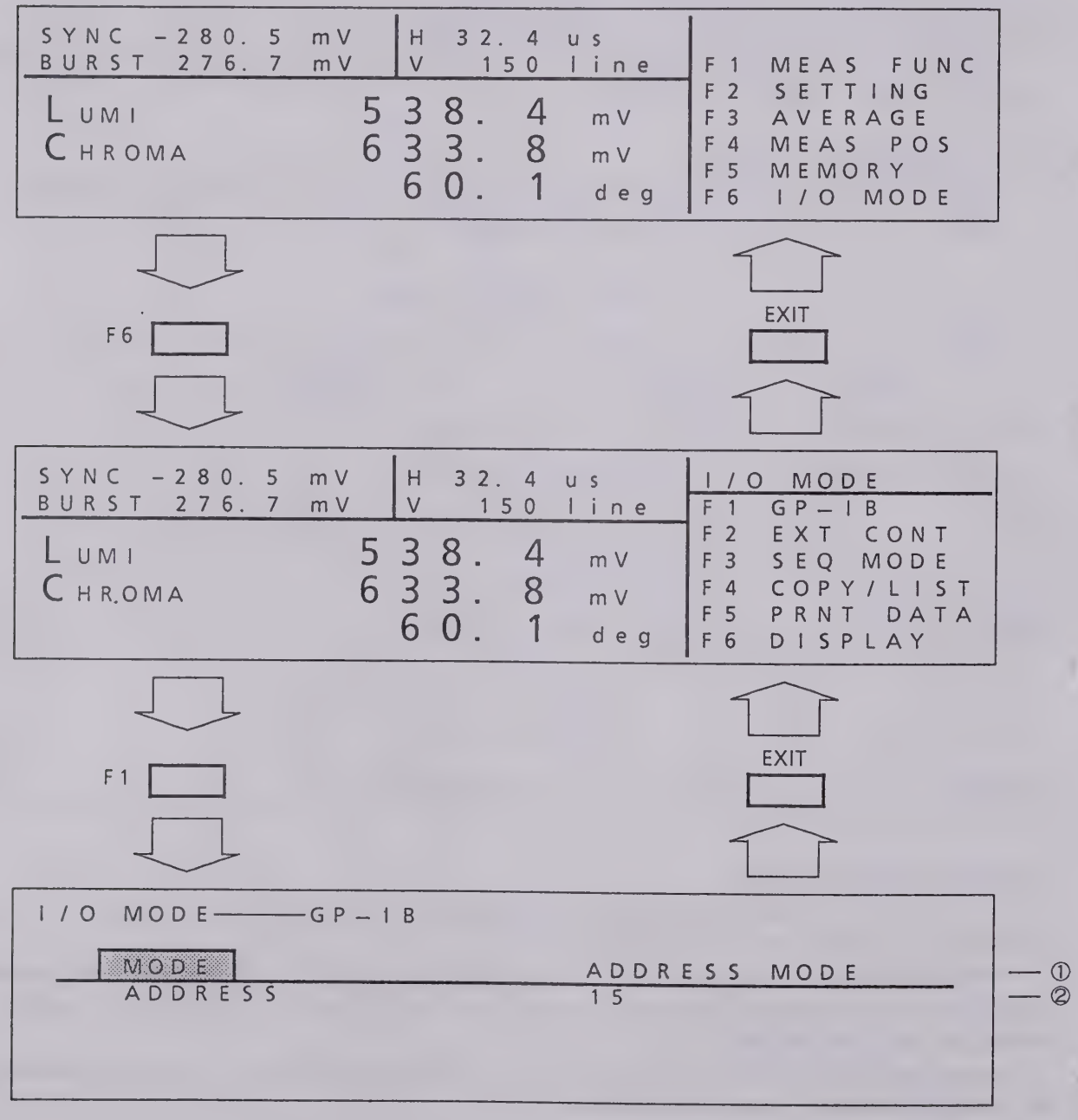
The content of the GP-IB setup screen is as follows:

① Mode display
Displays the GP-IB mode.

② Address
Displays the GP-IB device address.

Pressing the NEXT key with the GP-IB mode setup screen displayed, the mode and address display fields are sequentially displayed in reverse video. The item currently appears in reverse video can be set.

Example 6-1) To display the GP-IB mode setup screen

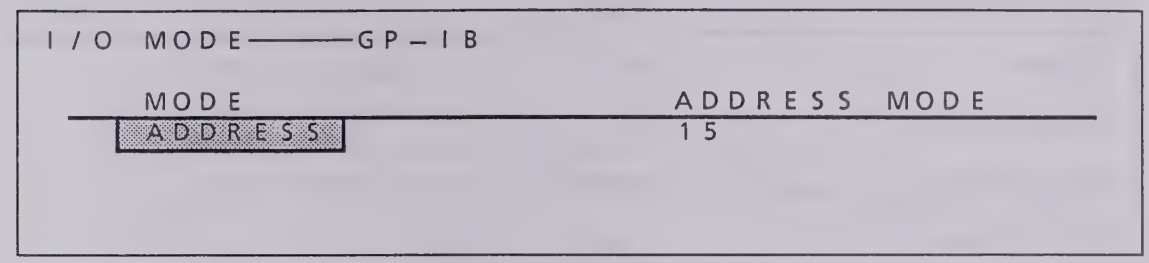


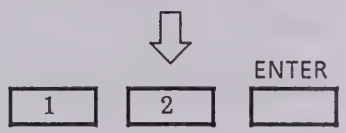
① : Mode display
② : Address display

(2) Setting procedure

Display the GP-IB mode setup screen and press the NEXT key to select the address display field. Now the GP-IB address is acceptable. Use the jog dial or the numeric keys to display the required GP-IB address. Then turn the power once off and then on again to set the GP-IB address.

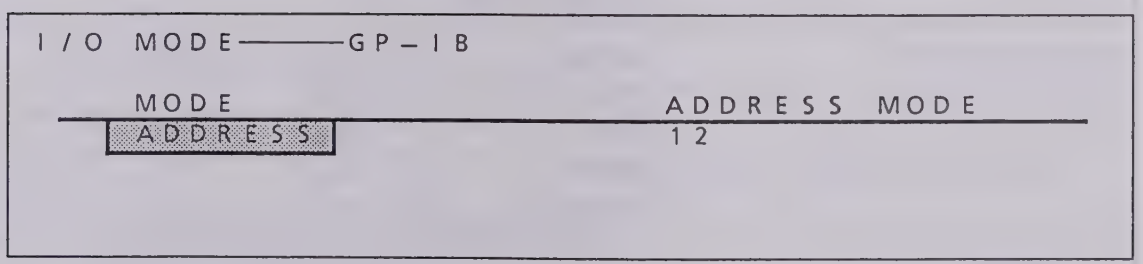
Example 6-2) To set 12 for the GP-IB address





Or

Use numeric keys ⑧ and the ENTER key of CONTROL block ⑤ or the jog dial / shuttle ring to display 12 for the address.



6-4 DEVICE CLEAR

Upon receiving DCL or SDC the analyzer returns to its initial state shown in Table 6-2.

Table 6-2 The initial state of the analyzer

Item	Description
Measuring function	Y & C
TV system	NTSC
Measurement unit	mV
Input connector	FRONT
Input impedance	REAR 1 : 75 Ω REAR 2 : 75 Ω REAR Y / C : 75 Ω
Sync polarity	SYNC NEGATIVE
Sync type	INT
External sync signal input impedance	75 Ω
Sample mode	2 FIELDS
Measuring range	1000 mV
Offset	0 mV
Summation average	Number of times : 1 Number of lines : 1
Measuring position	Sample H : 37.0 μs V : 150 line SYNC 2.4 μs BURST 6.6 μs RESET H : 2.4 μs V : 150 line REFERENCE H : 6.6 μs V : 150 line
H / V selection	H
External control output signal	Port 1 : 0 Port 2 : 0
Memory address	00
Auto sequence mode	REPEAT UP
Talker mode	00

6-5 FUNCTIONS REMOTELY UNCONTROLLABLE

Most of the operation on the panel are remotely controllable via the GP-IB. Table 6-3 lists the functions that cannot be controlled remotely via the GP-IB.

Table 6-3 Functions remotely uncontrollable via the GP-IB

Jog dial operation
Shuttle ring operation
Memory sequential recall
Grouping of memroy
Specification of a group in memory sequential recall
I/O mode setup (except the setting of auto sequence and print mode)

6-6 REMOTE/LOCAL FUNCTION

In the remote mode, the analyzer displays the GP-IB remote screen (Figure 6-1).

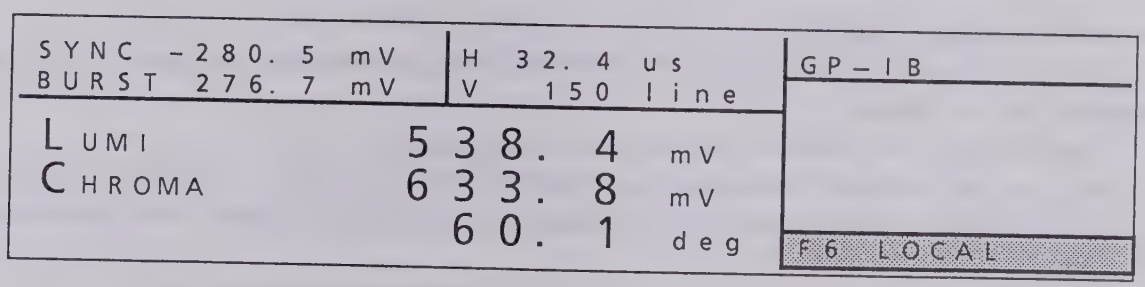


Figure 6-1 GP-IB remote display screen

The REMOTE/LOCAL function is controlled by the system controller and the F6 key (LOCAL key) on the analyzer's GP-IB remote display screen.

The analyzer must always be in any one of LOCAL, REMOTE or REMOTE with lockout.

(1) LOCAL

The analyzer is in the LOCAL state when :

(a) The power switch is turned on.

(b) the LOCAL key is pressed causing the REMOTE light to be turned off.

(c) receiving the GTL command.

(d) REN becomes FALSE in the REMOTE mode.

Note

When the mode is changed from remote to local, the conditions set in the LOCAL mode remain effective in the REMOTE mode.

(2) REMOTE

The analyzer is set in the REMOTE mode when REN is true and receives MLA.

Note

1. In the REMOTE mode the panel keys other than the POWER switch and the LOCAL key are invalid.
2. When the mode is changed from LOCAL to REMOTE, the conditions set in the LOCAL mode remain effective in the REMOTE mode.

(3) REMOTE with LOCKOUT

In this mode, it is not allowed to specify the LOCAL mode with the LOCAL key. To set the analyzer in the LOCAL mode, send a GTL (address command), make REN false, or turn the power once off then on again.

6-7 DEVICE TRIGGER FUNCTION

Using GET (device trigger) of the GP-IB multi line message, the measured value resulted by the command can be obtained.

Shown below is the procedure for using the device trigger:

(1) Assign on the controller the analyzer as a listener, send out program codes TM1 to TM31, and specify the talker mode for obtaining measured values. (As for the talker mode, see paragraph 6-10.)
(2) Assign the analyzer as a listener and issue the GET command (hexadecimal 08).
(3) Assign the analyzer as a talker and receive the measured values.

6-8 RESPONSE TO COMMAND

Table 6-4 shows the types of command and the analyzer's response to each of the commands.

Table 6-4 Analyzer's response to command

Type	Command	Description	Response
Universal command	DCL	DCL Device clear - Clears all devices	Yes
	SPE	Serial poll enable	No
	SPD	Serial poll disable	No
	PPU	Parallel poll unconfigure	No
	LLO	LLO Local lockout - Disables Remote / Local switch on responding devices	Yes
Address command	UNL	Unlisten - Clears Bus of all listeners.	Yes
	UNT	Untalk - Unaddresses the current talker so that no talker remains on the bus.	Yes
	SDC	Selective device clear - Clears addressed	Yes
	GTL	Go to local - Returns responding devices to local control	Yes
	PPC	Parallel poll configure	No
	GET	Group execute trigger	No
	TCT	Take control	No

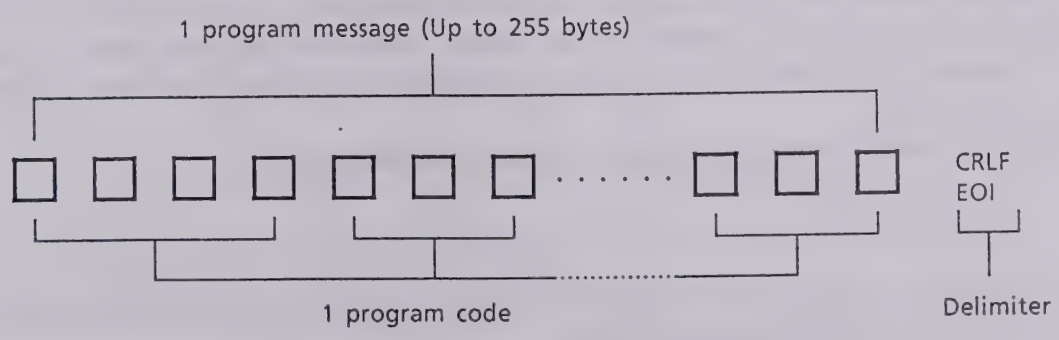
6-9 PROGRAM CODE INPUT FORMAT

Described below is the input format for the GP-IB program code.

(1) Input program message format

To use the GP-IB to set the analyzer in the required state, a program code must be sent from the controller to the analyzer.

The analyzer can receive up to 255 bytes of program codes for a program message in the ASCII code. The format of a program message is as shown below :



(2) Delimiter of a program message

The delimiter of a program message is one of the following:

(a) CRLF (hexadecimal 0D + 0A)

(b) LF (hexadecimal 0A)

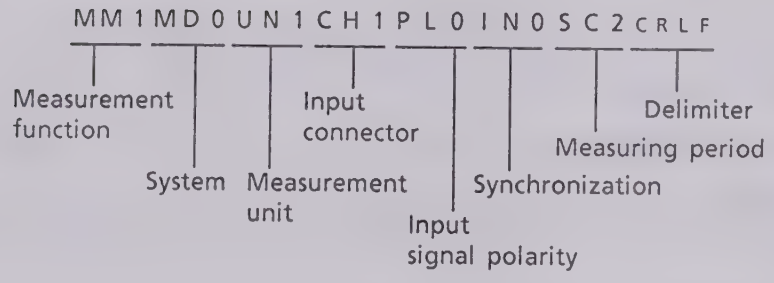
(c) EOI (GP-IB uniline message)

(3) Delimiter of a program code

No delimiter is required between program codes, but commas (,) and spaces (↓) can be inserted. Given below is an example program message.

Example 6-3) When nothing is inserted between program codes:

Set value:	Measurement function	Y & C
	System	NTSC
	Measurement unit	mV
	Input connector	FRONT
	Input signal polarity	SYNC NEGATIVE
	Measuring period	2 FIELDS



Example 6-4) When commas (,) are inserted between program codes

MM1, MD0. UN1, CH1, PL0, IN0, $SC2_{CRLF}$

Example 6-5) When spaces (↓) are inserted between program codes

MM1 ↓ MD0 ↓ UN1 ↓ CH1 ↓ PL0 ↓ IN0 ↓ $SC2_{CRLF}$

(4) Program code input format

A program code of the GP-IB interface consist of a header code, a data code, and a unit code.

Most of the header codes consist of two English uppercases, and data codes are generally numeric values. Unit codes consist of one or two English uppercases, but many program codes require no unit code.

The list of the GP-IB codes are provided at the back of this page.

Note

Do not insert spaces and commas in a program code, since they are handled as a separator between program codes.

6-10 PROGRAM CODE OUTPUT FORMAT

(1) General

The VP-8450A has the basic talker function and addressing it as a talker sends out various data. The content of data to be sent out differs according to the talker mode of the analyzer. The following shows the talker modes and the data they output.

Talker mode	Output data
0	Analyzer's setup state
1 to 31	Measured value
32	Data input to EXT CONTROL I/O interface port 2 (Data read function)
33	Input signal state

Given below are talker mode 1 to 31 that output measured values and the output data.

Table 6-5 Output data of measured values

Talker mode	Output data of measured value				
	SYNC level	BURST level	Luminance level	Chrominance level	Phase
1	○				
2		○			
3	○	○			
4			○		
5	○		○		
6		○	○		
7	○	○	○		
8				○	
9	○			○	
10		○		○	
11	○	○		○	
12			○	○	
13	○		○	○	
14		○	○	○	
15	○	○	○	○	
16					○
17	○				○
18		○			○
19	○	○			○
20			○		○
21	○		○		○
22		○	○		○
23	○	○	○		○
24				○	○
25	○			○	○
26		○		○	○
27	○	○		○	○
28			○	○	○
29	○		○	○	○
30		○	○	○	○
31	○	○	○	○	○

○ ····· Measured data to be output

Selection of the talker mode is made by a program code consisting of a header code TM, and a data code out of 0 to 32.

The data is sent out in 7-bit ASCII code with EOI and LF simultaneously output as delimiters. Given below are the output formats for each of the talker modes.

Note

1. In the Y measurement, 99999.9 is sent out as the measured values of the BURST level, chrominance level, and phase.
2. In the Peak-Peak, +Peak, and AC Peak measurement, the peak level measurement value is sent out without regard to the talker mode specified out of 1 to 31.
3. To send out two or more measurement data as talker mode 31 "TM31", a comma (,) is inserted between each data.

(2) Talker mode 0 "TM0"

Setting 0 for the talker mode sends out the analyzer's setup state when it is assigned as a talker.

The following shows the output format at the time.

MMd MDd UNd CHd TRd PLd INd CMd GNdd OSdddd
<1> <2> <3> <4> <5> <6> <7> <8> <9> <10>

SCdd AHdd SYddddd BUddddd
<11> <12> <13> <14>

MSddddd, dddd
<15>

RSddddd, dddd
<16>

RFddddd, dddd
<17>

NTddddd PAd P1Ddddd P2Ddddd CRLF
<18> <19> <20> <21> <22>

ddd ···· : Data code

Now the program code for each of <1> to <21> is discussed below.

	Program code	Data code	Description
<1>	MMd	1 to 6	Measurement function
<2>	MDd	0 to 1	System
<3>	UNd	1 to 2	Measurement unit
<4>	CHd	1 to 4	Input connector status
<5>	TRd	0 to 1	Input impedance status
<6>	PLd	0 to 1	Input signal polarity status
<7>	INd	0 to 2	Sync status
<8>	CMd	1 to 3	Measurement period status
<9>	GNdd	1 to 10	Input range status
<10>	OSddddd	-300 to 720	Offset value
<11>	SCdd	1 to 64	Number of times of summation average
<12>	AHdd	1 to 64	Number of lines of summation average
<13>	SYddddd	0.7 to 64.0	Sync point
<14>	BUddddd	0.7 to 64.0	Burst point
<15>	MSddddd,	0.7 to 64.0	Measuring point
	dddd	1 to 1250	
<16>	RSddddd,	0.7 to 64.0	Reset point
	dddd	1 to 1250	
<17>	RFddddd,	2.7 to 64.0	Reference point
	dddd	1 to 1250	
<18>	NTddddd	0.1 to 99.9	Interval time of current memory address
<19>	PAd	0 to 1	Print assignment status of current memory address
<20>	P1Dddd	0 to 255	Set value of port 1 external control output signal
<21>	P2Dddd	0 to 255	Set value of port 2 external control output signal
<22>	CRLF		Delimiter (EOI message generated with LF)

(3) Talker mode 1 to 31 "TM1 to 31"

Setting the talker mode to one out of 1 to 31 sends out various measurement values whose output format are described below.

(a) The output format of level measurement values

The unit is mV or IRE when sending out the measured values of the SYNC, BURST, luminance, chrominance and peak levels. The output format is as follows:

± ddddd. d

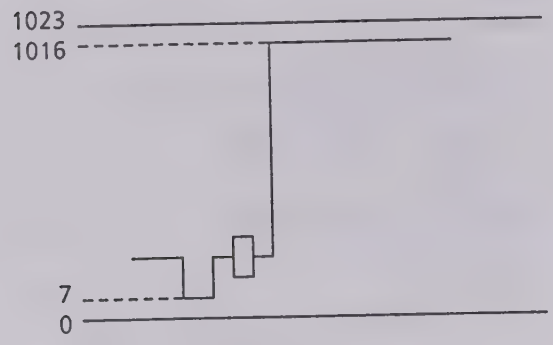
(b) The output format of phase measurement value

The unit for sending out the phase measurement value is degree. The output format is as follows:

± ddddd. d

(c) The output of signal level error

+ or – 9999.9 output indicates an erroneous measurement of SYNC level, BURST level, luminance level, chrominance level, peak level or phase affected by an inappropriate input level exceeding the limits shown in Figure 6-1.



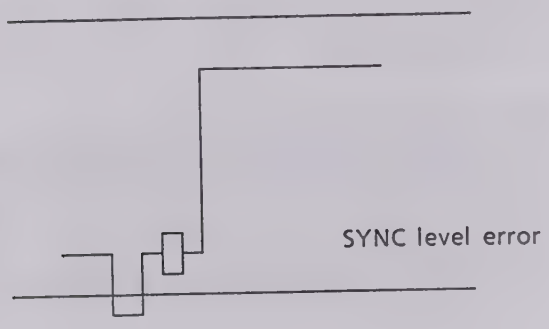
7 mV ≦ Input level ≦ 1016 mV

Figure 6-1 Allowable input level range for error-free measurement

Example 6-1) Data indication when SYNC level exceeds the limit.

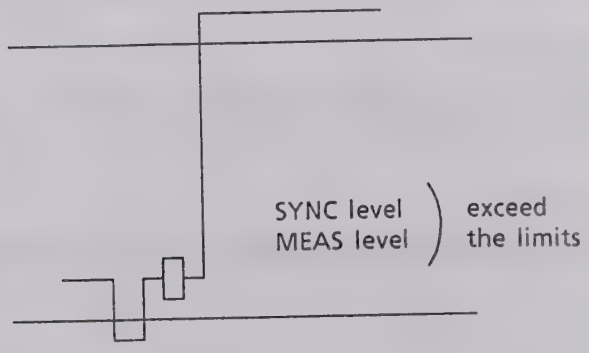
Measurement range : 1000 mV

Offset : – 100 mV



SYNC level :	– 9999.9
BURST level :	Measured value
Luminance level :	Measured value
Chrominance level :	Measured value
Phase :	Measured value

Example 6-2) Data indication when input level is more than 1 Vp-p.



SYNC level :	– 9999.9
BURST level :	Measured value
Luminance level :	+ 9999.9
Chrominance level :	+ 9999.9
Phase :	+ 9999.9

Note) Exceeding the upper limit : "+ 9999.9" is indicated.

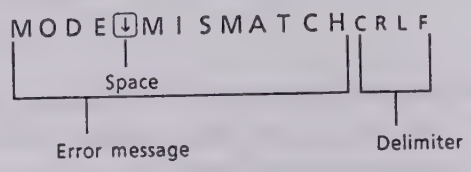
Exceeding the lower limit : "– 9999.9" is indicated.

(4) Talker mode 32 "TM32"

Setting the talker mode 32 when the analyzer is assigned as a talker sends out in decimal notation the 8-bit data applied to port 2 of the EXTERNAL CONTROL I/O interface. This is called the data read function and discussed in detail in paragraph 7-10. The output format is as follows:

d d d CR LF d d d: 0 to 255
CR LF: Delimiter (EOI message generated with LF)

If the I/O mode of the port 2 of the EXTERNAL CONTROL I/O interface is not in the data read mode, the following message is sent out.



(5) Talker mode 33 "TM 33"

Setting the talker mode to 33 when the analyzer is assigned as a talker sends out the input signal status. The output data at the time and its content are given below.

Send data	Content
0	No error
1	SYNC level error
2	Burst level error
3	SYNC level error, burst level error
4	Subcarrier frequency error
5	SYNC level error, subcarrier frequency error
6	Burst level error, subcarrier frequency error
7	SYNC level error, burst level error, subcarrier frequency error

Output format is as follows:

d CR LF

6-11 MEMORY SYNC FUNCTION, MEMORY COPY FUNCTION

(1) General

The VP-8450A has the two functions that uses the GP-IB interface: the memory sync function which allows simultaneously recalling of two or more sets of the assorted preset memory data and the memory copy function which allows transferring of the content of the preset memory mutually between the two VP-8450As.

(a) Memory sync function

Connect with the GP-IB connector a master set and one or more slave sets to perform recall operation of the associated preset memory on the master set.

Then the program code is sent out from the master set to the slave set or sets for recalling memory data, and the address identical to that of the master set is recalled also on the slave set or sets.

(b) Memory copy function

Connect with the GP-IB connector one master set and one or more slave sets to start the memory copy function on the master set. Then all or part of the preset memory of the master set can be transferred to the slave set. In this operation, the slave sets must be of identical model with the master set.

Follow the procedure below.

(2) Displaying the GP-IB mode setup screen

Press the F6 key with the initial menu on screen to display the I/O mode menu. If the display other than the initial menu is currently on screen, press the EXIT key to bring the initial menu on screen and then press the F6 key.

Pressing the F1 key with the I/O mode menu on screen displays the GP-IB mode setup screen. An example operation is given in example 6-6.

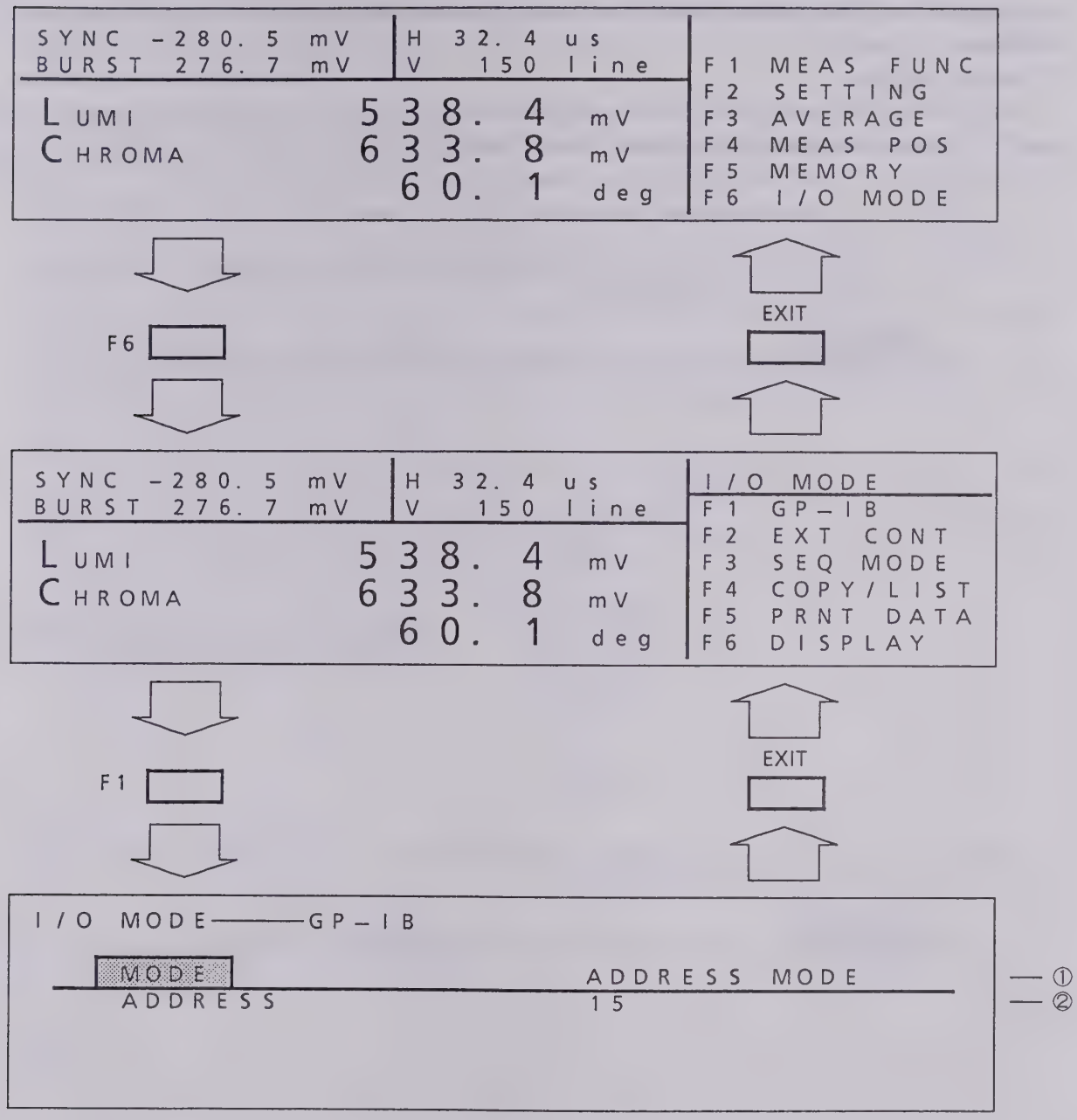
The content of the GP-IB setup screen is as follows:

① Mode display
Displays the GP-IB mode.

② Address display
Displays the GP-IB device address.

Pressing the NEXT key with the GP-IB mode setup screen displayed, the mode and address display fields are sequentially displayed in reverse video. The item currently appears in reverse video can be set.

Example 6-6) To display the GP-IB mode setup screen



① : Mode display
② : Address display

The relationship between the messages in the mode display field and the modes is shown below.

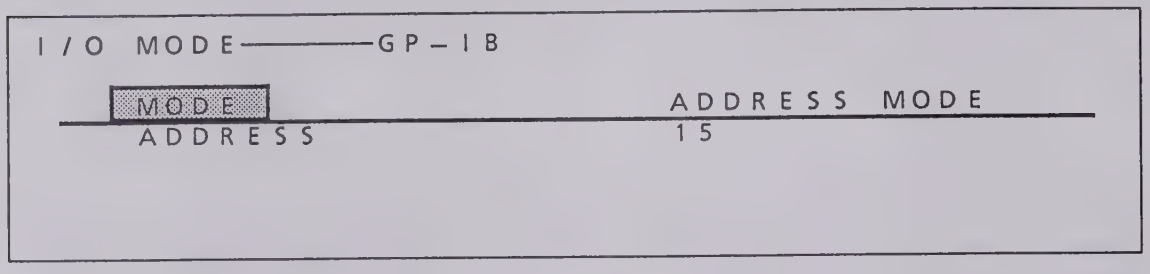
Mode display field	Mode
ADDRESS MODE	Canceling master / slave
MEMORY SLAVE	Slave mode of memory sync function
MEMORY MASTER	Master mode of memory sync function
COPY SLAVE	Slave mode of memory copy function
COPY MASTER	Master mode of memory copy function

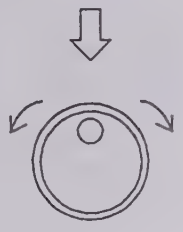
The master / slave mode corresponds to the talk only / listen only function of the GP-IB. Therefore, if the GP-IB control involving addressing (normal GP-IB control) is required, the master / slave must be canceled.

(3) Setting procedure

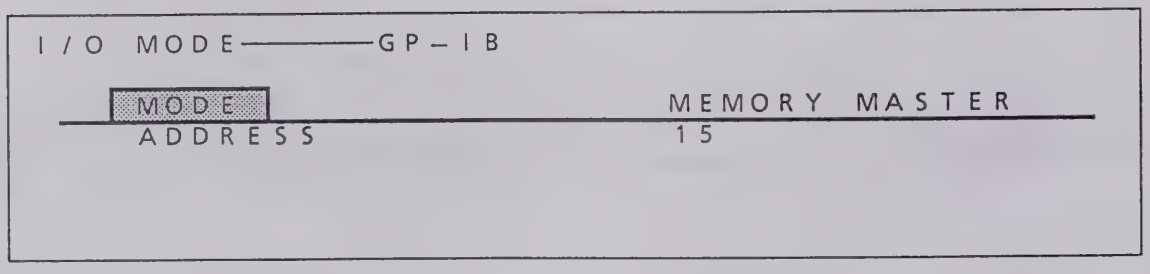
Display the GP-IB mode setup screen and press the NEXT key to select the mode display field. Now the GP-IB mode setup is acceptable. Rotate the jog dial to display the required mode, turn the power once off, and then turn it again. Then the master / slave mode can be set.

Example 6-7) To select the master mode of the memory sync





Rotate the jog dial / shuttle ring ⑥ to display MEMORY MASTER.



(4) Memory sync operation

Performing memory recall operation on the master set simultaneously recalls the memory of the slave set. Direct recall, sequential recall, and auto sequence sync operations are also available. See paragraphs 4-13 and 4-14 for details.

(5) Memory copy operation

The memory copy operation sets the range of the memory addresses to be copied and starts copying.

(a) Setting memory address range

Set the start and end addresses on the master set and start copying. This copies the content of the associated preset memory only from the start to end addresses.

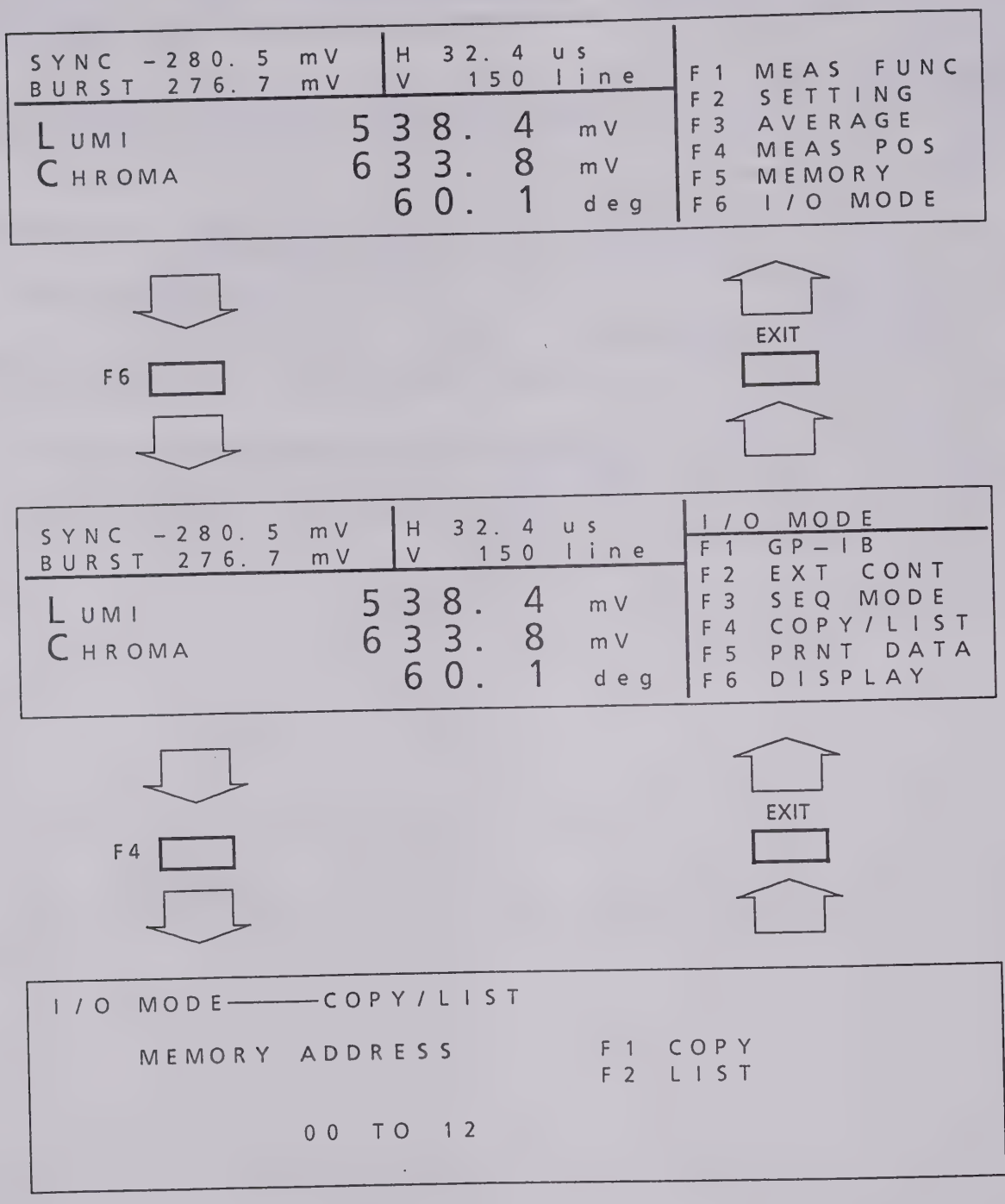
Canceling the start and end addresses enables copying the entire associated preset memory.

(b) Starting copying

Press the F6 key with the initial menu on screen to display the I/O mode menu. If the display other than the initial menu is on screen, press the EXIT key to return the display to the initial menu and then press the F6 key.

Pressing the F4 key with the I/O mode menu on screen displays the copy/list screen. Then press the F1 key to start memory copying. During copying, the F1 COPY display field appears in reverse video disabling operation on the panel. Upon completion of copying, the field returns to normal video display enabling the panel operation.

Example 6-8) Starting copying memory



Press the COPY (F1) key to start copying.

SECTION VII
EXTERNAL CONTROL INTERFACE (EXT CONTROL I/O)

7-1 GENERAL

Separately from the GP-IB interface, the VP-8450A has an external control interface unique to it. The connector for the interface is provided on the rear panel. Given below is the general description of the basic function.

(1) General description of the external control interface function

The following functions are available using the EXT CONTROL I/O connector.

(a) Remote sequential recall

The remote sequential recall operation can be remotely controlled.

(b) Remote modification

The measuring position (H/V) can be remotely controlled on an external device.

(c) Remote direct recall

The memory direct recall operation can be remotely controlled on an external device.

(d) Control output

An 8-bit x 2 port TTL output signal for external device control can be obtained.

(e) Print out of memory content (list output)

The content of the preset memory can be written on the printer.

(f) Data read

External 8-bit TTL input signals can be read via the GP-IB controller.

The following paragraphs 7-2 to 7-11 describe the detailed operation procedure of the EXT CONTROL I/O interface.

7-2 PIN CONNECTION AND ASSIGNMENT

(1) Pin connection

Figure 7-1 shows the pin connection of the EXT CONTROL I/O connector.

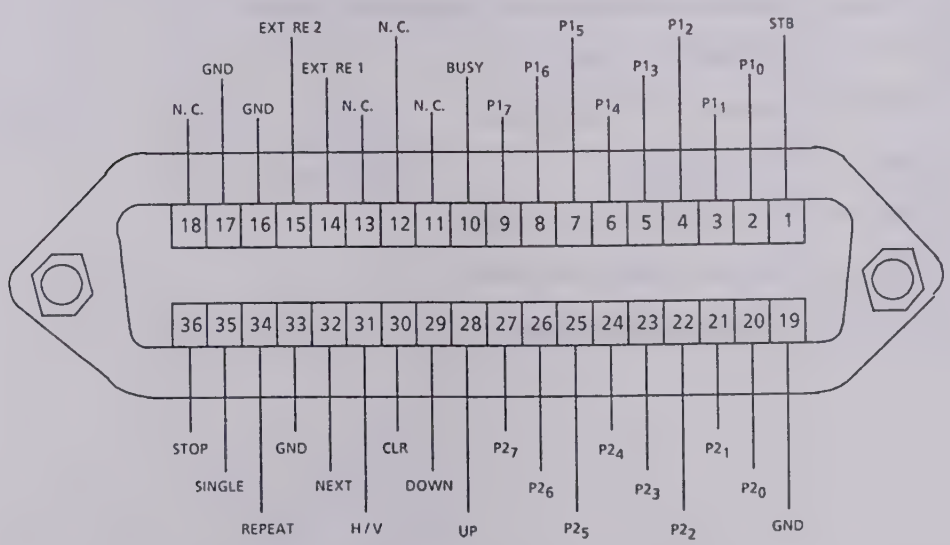


Figure 7-1 EXT CONTROL I/O connector pin assignment

Use the shielded type 36-pin plugs and cables ; otherwise, it may result in malfunction caused by electrostatic disturbance or other environmental effects.

Use the optional VQ-023H10 cable for using the memory list output function.

(2) Pin function

Number	Pin	Function
1	STB	Connects the timing pulse for reading data during memory direct recall. Also connects printer's acknowledge signal during memory list output.
2 to 9	$P1_0$ to $P1_7$	Connects 8-bit data input and output for control output, memory direct recall, memory list output, and data print functions (port 1).
10	BUSY	Outputs signals during memory direct recall informing the analyzer is disabled to receive data. Also outputs, during memory list output and data printing, strobe signals from the analyzer to the printer.
11 to 13	N. C.	Not connected to internal circuit.
14	EXT RE 1	External rotary encoder connector 1.
15	EXT RE 2	External rotary encoder connector 2.
16 to 17	GND	Chassis ground.
18	N. C.	Not connected to internal circuit.
19	GND	Chassis ground.
20 to 27	$P2_0$ to $P2_7$	Inputs and outputs 8-bit data for control output and data read (port 2).
28	UP	Connects UP key input for sequential recall.
29	DOWN	Connects DOWN key input for sequential recall.
30	CLR	Connects CLR key input for sequential recall.
31	H/V	Connects H/V key input.
32	NEXT	Connects NEXT key input.
33	GND	Chassis ground.
34	REPEAT	Connects REPEAT key input.
35	SINGLE	Connects SINGLE key input.
36	STOP	Connects STOP key input.

7-3 SELECTING EXTERNAL CONTROL INTERFACE MODE

Use the panel keys to set the mode of the EXT CONTROL I/O interface.

(1) Displaying the EXT CONTROL I/O interface setup screen

Press the F6 key with the initial menu on screen to display the I/O mode menu. If the display other than the initial menu is on screen, press the EXIT key to return the display to the initial menu and then press the F6 key.

Pressing the F2 key with the I/O mode menu on screen displays the EXT CONTROL I/O interface setup screen. Example 7-1 shows the example operation.

The EXT CONTROL I/O interface setup screen includes the following:

① Port 1 mode display
Displays the mode of the EXT CONTROL I/O port 1.

② Port 2 mode display
Displays the mode of the EXT CONTROL I/O port 2.

③ Port 1 control output data display
Displays the control output data of the EXT CONTROL I/O port 1.

④ Port 2 control output data display
Displays the control output data of the EXT CONTROL I/O port 2.

Pressing the NEXT key with the EXT CONTROL I/O interface setup display on screen displays the port 1 mode display field, port 2 mode display field, port 1 control output data display field, and port 2 control output data display field sequentially in reverse video. The item currently displayed in reverse video can be set.

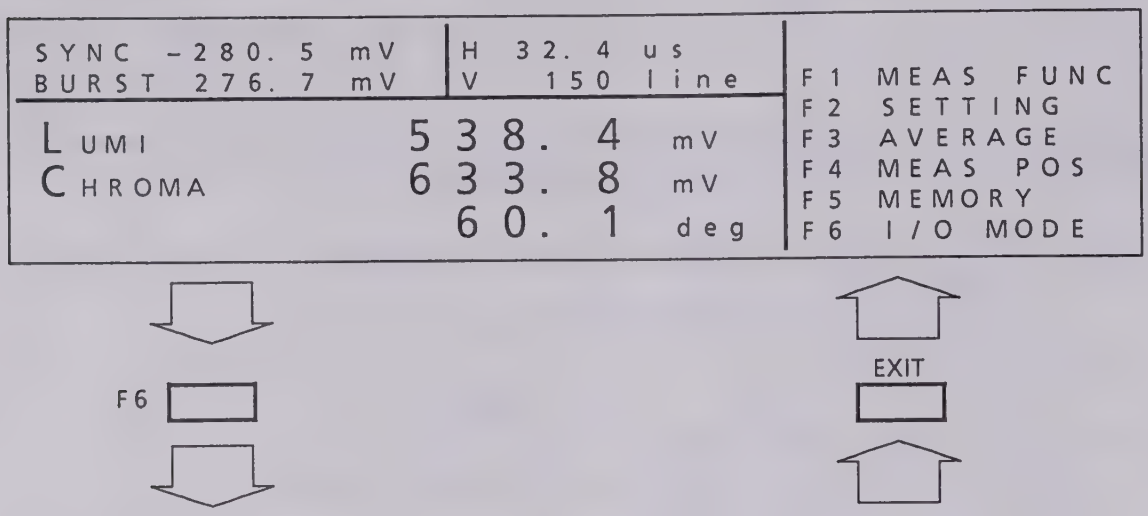
The following shows the relationship between the port 1 mode display field and port 2 mode display field, and their modes.

Port 1 mode display	Mode
CONTROL OUTPUT	Control output
MEMORY RECALL	Memory direct recall
PRINTER OUTPUT	Memory list output
	DATA PRINT output

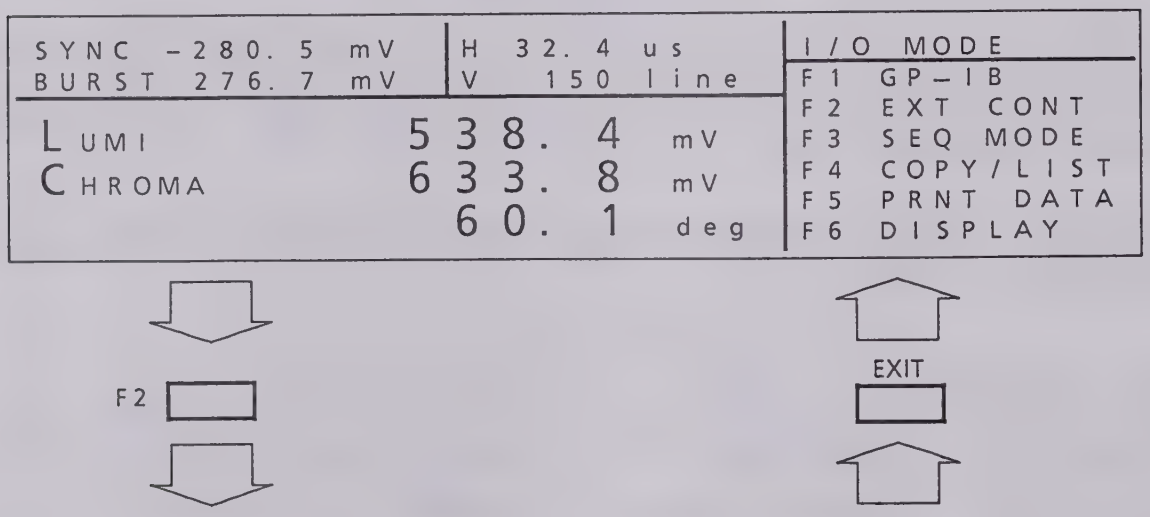
Port 2 mode display	Mode
CONTROL OUTPUT	Control output
DATA READ	Data read

Example 7-1) To display the EXT CONTROL I/O setup screen

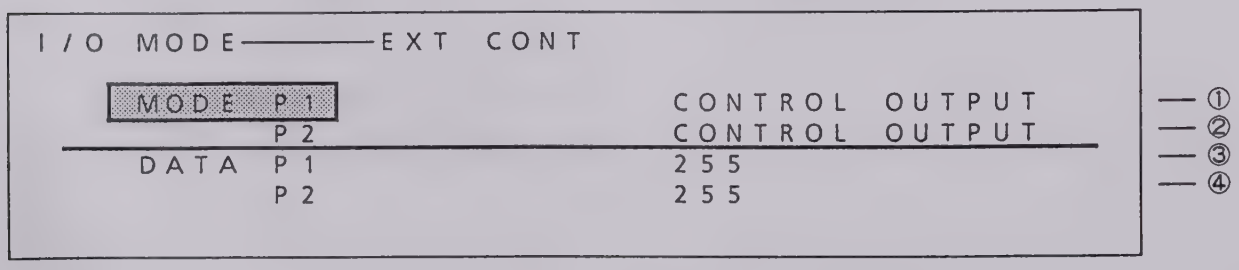
Initial menu screen



I/O mode menu screen



EXT CONTROL I/O setup screen

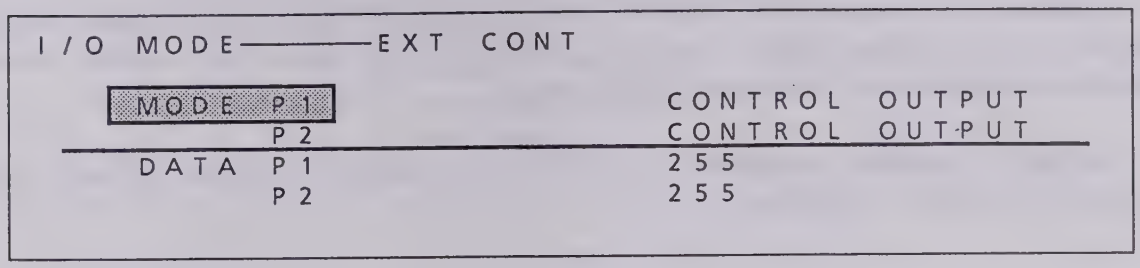


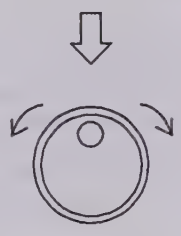
① : Port 1 mode display
② : Port 2 mode display
③ : Port 1 control output data display
④ : Port 1 control output data display

(2) Setup operation

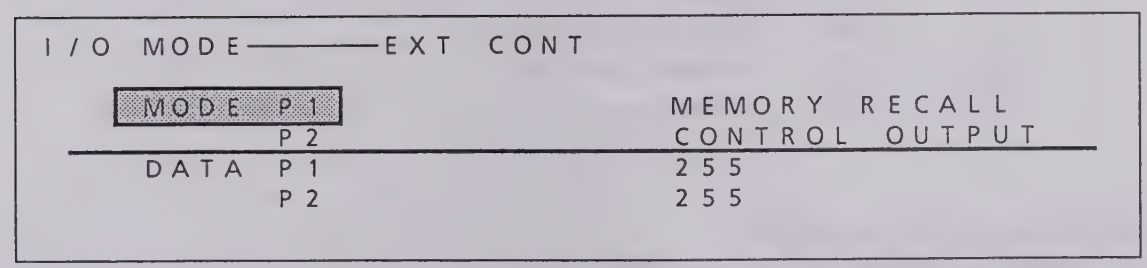
Display the EXT CONTROL I/O interface setup screen and press the NEXT key to select port 1 mode display field or port 2 display field. Now port 1 or port 2 setup is acceptable. Rotate the jog dial to display the required mode, and then turn the power once off and on again to set the mode for the EXT CONTROL I/O interface.

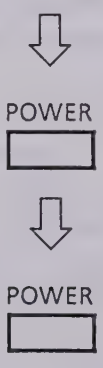
Example 7-2) To select the direct recall mode for port 1.





Rotate jog dial / shuttle ring ⑥ to display MEMORY RECALL.





Turn the power once off and then on again.

7-4 OPERATIONS COMMON TO ALL EXTERNAL CONTROL INTERFACE FUNCTIONS

The EXT CONTROL I/O interface is the control I/O based on the TTL logic. Discussed below are the common operations.

(1) Input signal

The input signal is a TTL-level logic signal. Since each of the input connectors is internally pulled up to +5V with the resistance of 47 kΩ , HIGH and LOW of the input signal is to be controlled by opening or shorting the input connector and the GND connector.

(2) Connector cable

To connect the analyzer with a printer by the memory list output, use optional cable VQ-023H10. Using unshielded plugs or cables may result in malfunction of the analyzer caused by electrostatic disturbance or other environmental effects.

Described in following paragraphs 7-5 to 7-11 are the operation procedures for each function of the EXT CONTROL I/O interface.

7-5 REMOTE SEQUENTIAL RECALL

(1) Function

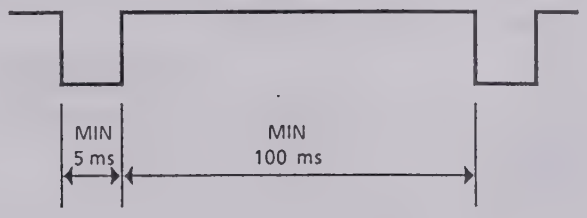
Remotely controls up, down, and clearing of the associated preset memory.

(2) Connectors used

Number	Name	Function
28	UP	Connects UP signal.
29	DOWN	Connects DOWN signal.
30	CLR	Connects CLR signal.
33	GND	Chassis ground.

(3) Electrical operation characteristics

UP, DOWN, and CLEAR of the memory are activated on the rising edge where the signal applied to each of the UP, DOWN, and CLR connectors shifts from LOW to HIGH. The timing condition is as shown below :



7-6 REMOTE MODIFYING

(1) Function

Remotely controls the modifying operation using the rotary encoder.

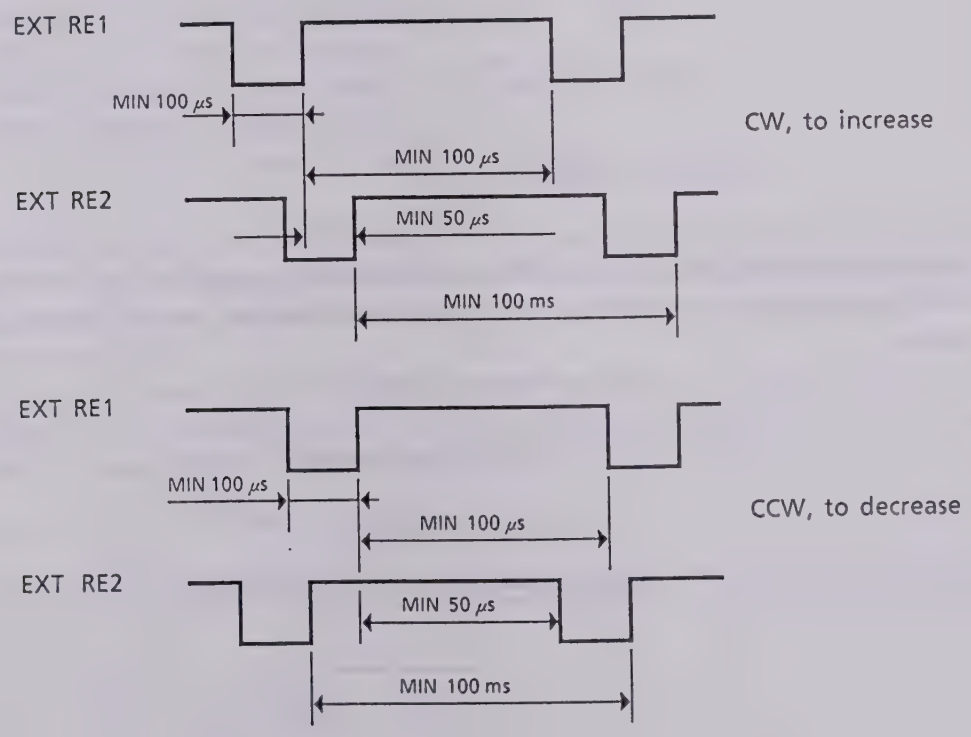
(2) Connectors used

Number	Name	Function
14	EXT RE 1	External rotary encoder connector 1
15	EXT RE 2	External rotary encoder connector 2
16	GND	Chassis ground
31	H/V	Connects H/V key input
32	NEXT	Connects NEXT key input
33	GND	Chassis ground

(3) Operation characteristics

To modify the measuring position, select H and V positions at the rising edge where the signal applied to each of the H and V connectors shifts from LOW to HIGH. The timing condition is the same as that given in paragraph 7-5 (3).

Use for the rotary encoder of to be connected to EXT RE 1 and EXT RE 2. The time conditions for the modification signal are shown below.



7-7 REMOTE DIRECT RECALL

(1) Function

This is the function to remotely control the memory direct recall operation.

(2) Available connectors

Number	Name	Function
1	STB	Connects the timing pulse input for reading data.
2 to 9	$P1_0$ to $P1_7$	Connects address data input.
10	BUSY	Outputs the signal informing the analyzer is in being disabled to receive data.
19	GND	Chassis ground.

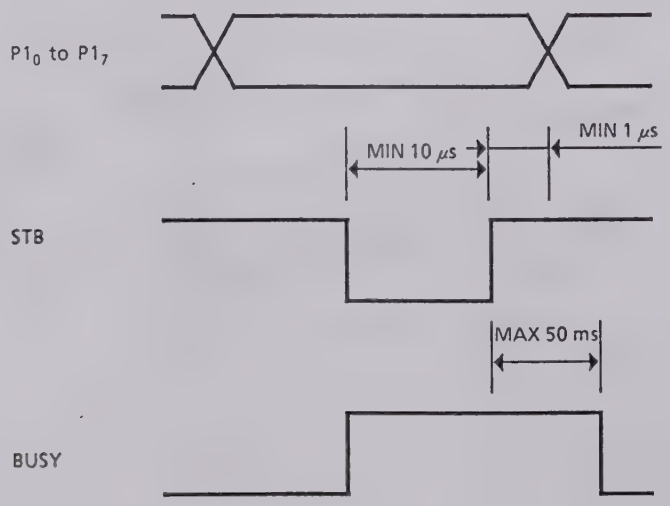
(3) Operation characteristics

Use the BCD code to set address data between 00 to 31 for connectors $P1_0$ to $P1_7$. The input data for each of the connectors and their address data are as shown below.

Output signal								Address data
$P1_7$	$P1_6$	$P1_5$	$P1_4$	$P1_3$	$P1_2$	$P1_1$	$P1_0$	
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1
				to				to
0	0	0	0	1	0	0	1	9
0	0	0	1	0	0	0	0	10
				to				to
0	0	1	1	0	0	0	1	31

0 : LOW (= 0 V) 1 : HIGH (= + 5 V)

By applying the timing pulse to the STB connector after setting the above address data, the memory of the set address is recalled. The timing conditions for each of the connectors are as shown below.



7-8 CONTROL OUTPUT

(1) General description of the function

Supplies the TTL signal for controlling external devices. The number of signals is up to 8 bits × 2 ports.

(2) Available connectors

Number	Name	Function
2 to 9	$P1_0$ to $P1_7$	Outputs 8-bit control signal (Port 1)
20 to 27	$P2_0$ to $P2_7$	Outputs 8-bit control signal (Port 2)
19	GND	Chassis ground

(3) Display

The set value of the control output signal is displayed on the EXT CONTROL I/O interface setup screen. Press the F6 key with the initial menu on screen to display the I/O mode menu screen. If the screen other than the initial menu is being displayed, press the EXIT key to bring the initial menu on screen and then press the F6 key.

Pressing the F2 key with the I/O mode menu on screen displays the EXT CONTROL I/O interface setup screen. An example operation is shown in Example 7-3.

The EXT CONTROL I/O interface setup screen contains the following:

① Port 1 mode display
Displays the mode of EXT CONTROL I/O port 1.

② Port 2 mode display
Displays the mode of EXT CONTROL I/O port 2.

③ Port 1 control output data display
Displays the control output data of EXT CONTROL I/O port 1.

④ Port 2 control output data display
Displays the control output data of EXT CONTROL I/O port 2.

Press the NEXT key with the EXT CONTROL I/O setup screen displayed. Then port 1 mode display field, port 2 mode display field, port 1 control output data display field, and port 2 control output data display field are displayed sequentially in reverse video indicating that the field is ready to accept setting data.

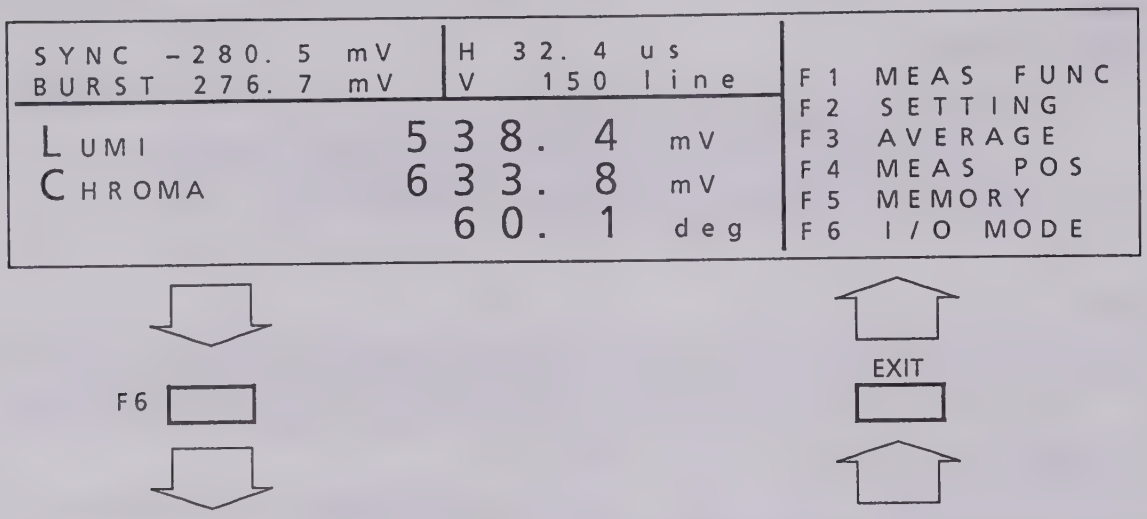
The set values are the 8-bit data of port 1 and port 2 displayed in decimal data from 0 to 255 with $P1_0/P2_0$ as LSB and $P1_7/P2_7$ as MSB. Given below is the relationship between the set value and the signals available from the EXT CONTROL I/O connector.

Set value	Signal output							
	$P1_7/P2_7$	$P1_6/P2_6$	$P1_5/P2_5$	$P1_4/P2_4$	$P1_3/P2_3$	$P1_2/P2_2$	$P1_1/P2_1$	$P1_0/P2_0$
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	1
to				to				
254	1	1	1	1	1	1	1	0
255	1	1	1	1	1	1	1	1

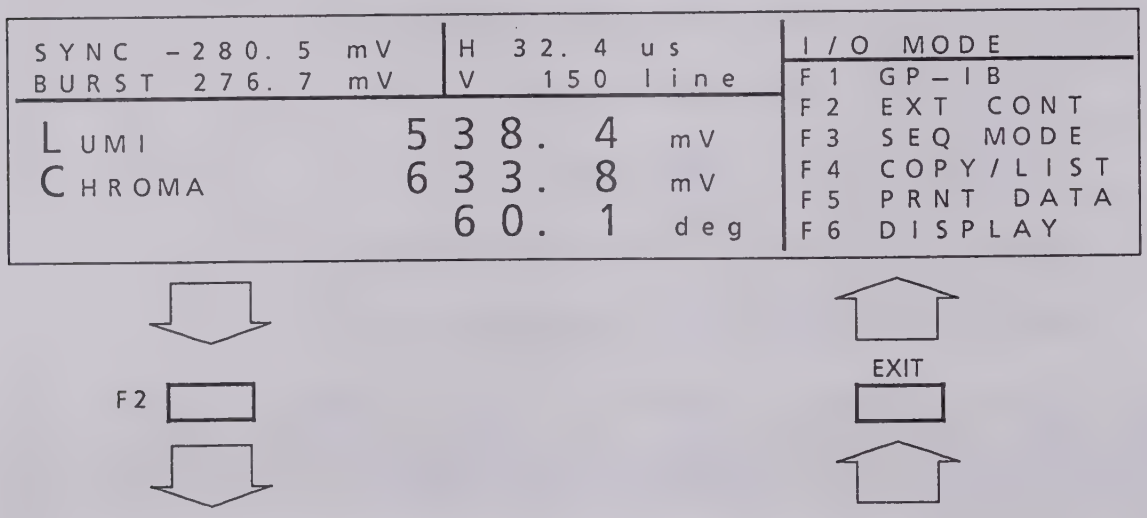
0 : LOW (= 0 V) 1 : HIGH (= +5 V)

Example 7-3) The EXT CONTROL I/O setup screen display

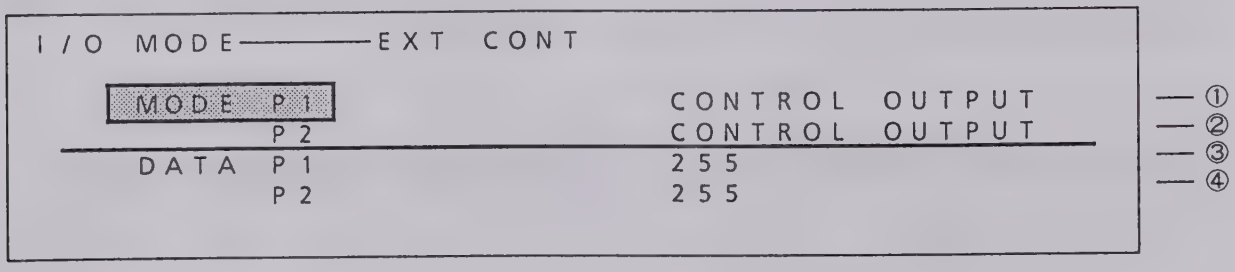
Initial menu screen



I/O mode menu screen



EXT CONTROL I/O setup screen

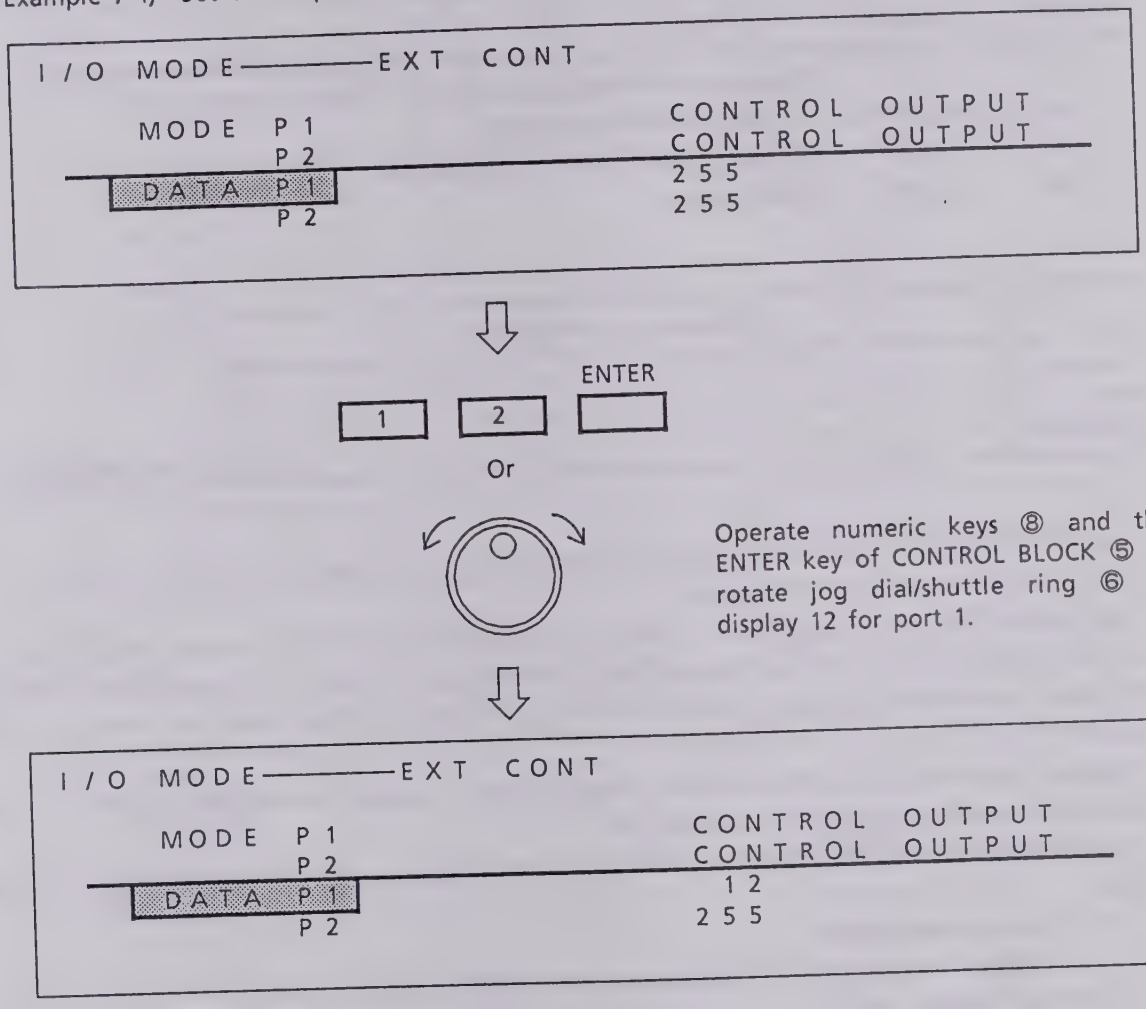


① : Port 1 mode display
② : Port 2 mode display
③ : Port 1 control output data display
④ : Port 2 control output data display

(4) Setting procedure

Display the EXT CONTROL I/O interface setup screen and press the NEXT key to select port 1 control output data display field or port 2 control output data display field. Now the control output setup for port 1 or port 2 is acceptable. By using the jog dial or the numeric keys to display the required numeric value, the external control output signal can be set.

Example 7-4) Set 12 for port 1 control output



(5) GP-IB program code

Setting the control output signal can be controlled by the GP-IB.

Table 7-1 GP-IB program code for control output

Header code	Data code	Unit code	Description
P1 or P2	B00000000 to B11111111		Sets in binary data the control output of port 1 or port 2.
	H00 to HFF		Sets in hexadecimal data the control output of port 1 or port 2.
	D0 to D255		Sets in decimal data the control output of port 1 or port 2.
	S0 to S7		Sets (to 1) the specified bit of port 1 or port 2.
	R0 to R7		Resets (to 0) the specified bit of port 1 or port 2.

7-9 PRINT OUT OF THE MEMORY CONTENT (LIST OUTPUT)

(1) General

Supplies all or part of the content of the associated preset memory to the printer of CENTRONICS equivalent.

(2) Available connectors

Number	Name	Function
1	STB	Connects acknowledge signal input from the printer
2 to 9	$P1_0$ to $P1_7$	Outputs data to the printer
10	BUSY	Outputs strobe signals to the printer
19	GND	Chassis ground

	Connecter pin assignment										
Printer	1	2	3	4	5	6	7	8	9	10	19
VP-8450A	10	2	3	4	5	6	7	8	9	1	19

Other pins are N.C.

Use the VQ-023H10 cable for connecting the analyzer to a printer.

(3) Displaying MEMORY COPY/LIST screen

The memory list output operation is done on the MEMORY COPY/LIST screen. Press the F6 key with the initial menu on screen to display the I/O mode menu screen. If the screen other than the initial menu is being displayed, press the EXIT key to bring the initial menu on screen and then press the F6 key.

Pressing the F4 key with the I/O mode menu on screen displays the MEMORY COPY/LIST screen. An example operation is shown in Example 7-5.

Described below are the MEMORY COPY/LIST screen display and the applications of the keys defined.

① Start address display
Displays the start address for memory list output or memory copy.

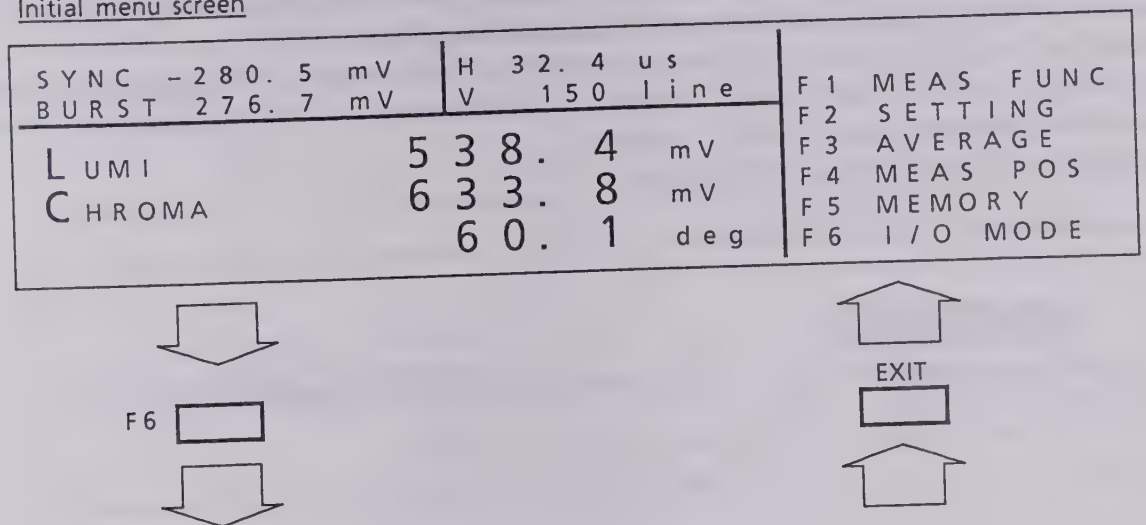
② End address display
Displays the end address for memory list output or memory copy.

③ F1 key defined as the COPY key
Used as memory copy output execution key.

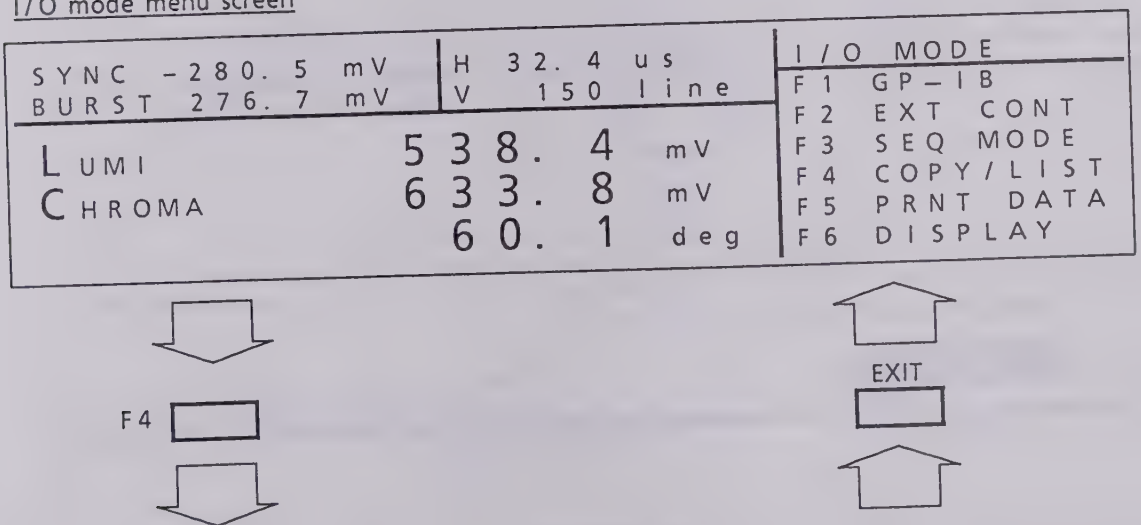
④ F2 key defined as the LIST key
Used as memory list execution key.

Example 7-5) Displays MEMORY COPY/LIST screen

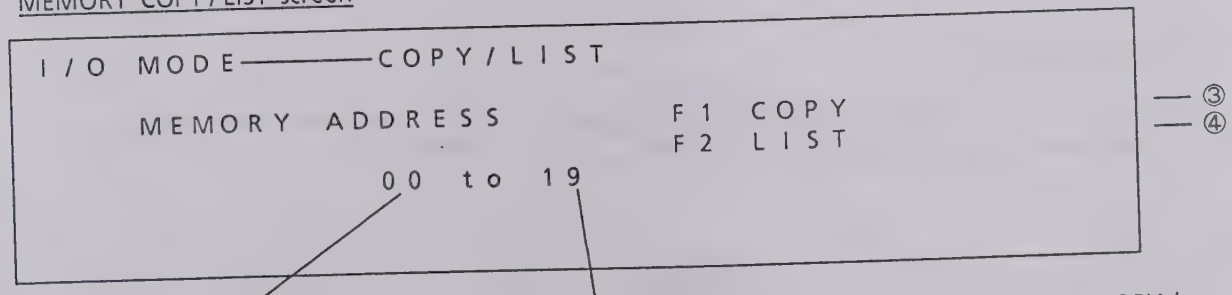
Initial menu screen



I/O mode menu screen



MEMORY COPY/LIST screen



① Start address display

② End address display

③ F1: Defined as COPY key

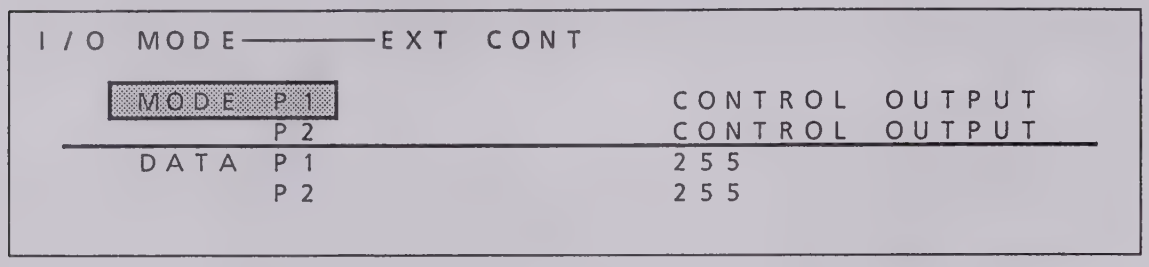
④ F2: Defined as LIST key

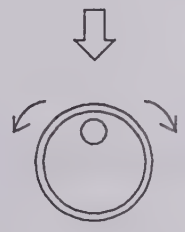
(4) Operation procedure

Set the printer output mode for port 1. Then set the start and end addresses of the portion to be output to the printer. Finally, display the MEMORY COPY / LIST setup screen and press the memory list output execution key (F2 key) to execute the list operation.

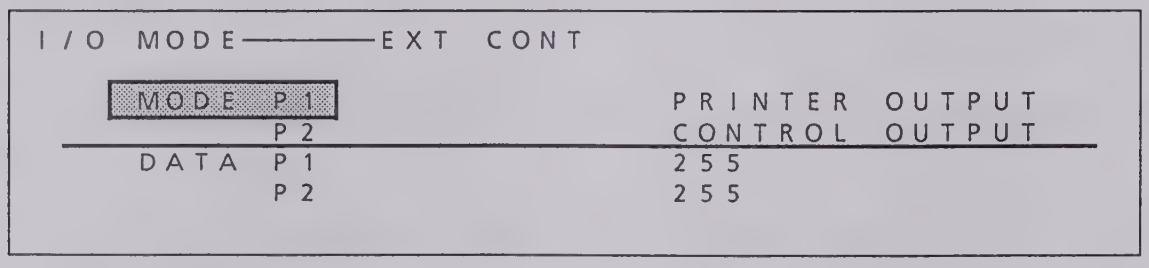
While the list output operation is being executed, the list key display field appears in reverse video disabling panel operation. Upon completion of the operation, the list key display field returns to normal display enabling panel operation.

Example 7-6) Memory list output operation

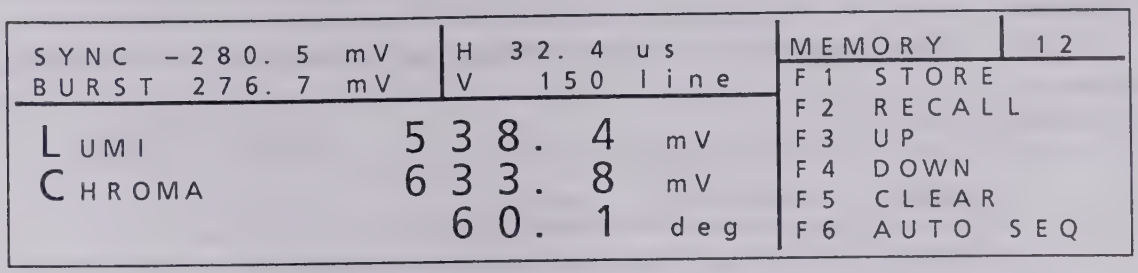




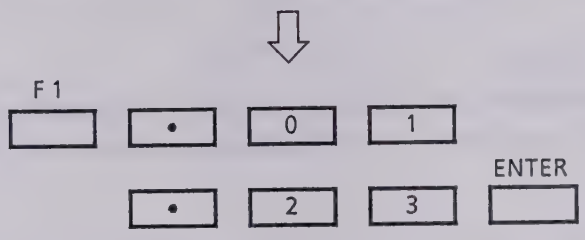
Rotate jog dial/shuttle ring ⑥ to display PRINTER OUTPUT.



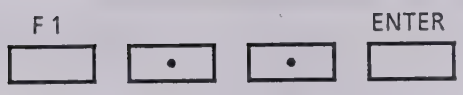
Turn the power once off then on again.



Display the memory menu screen

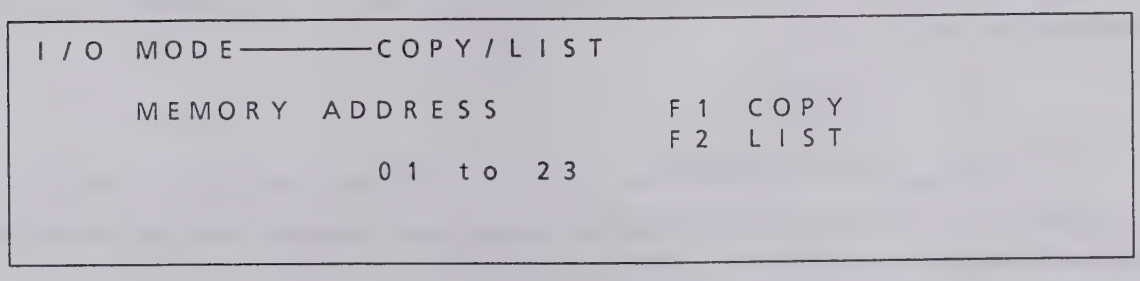


Set the start address (example: 01) and the end address (example: 23).



Cancel the start and end addresses when the entire data is to be list output.

Connect the printer to the EXT CONTROL I/O connector of the analyzer using the VQ-023H10 cable.



Display the COPY/LIST screen and press the LIST key (F2 key) to start the list output operation.

7-10 DATA READ

(1) General

The GP-IB control allows reading the 8-bit TTL-level data connected to the EXT CONTROL I/O connector.

(2) Available connectors

Number	Name	Function
20 to 27	$P2_0$ to $P2_7$	8-bit data input connector (port 2)
19	GND	Chassis ground

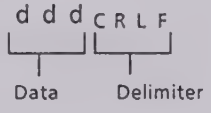
(3) Data output format

Sent out to the GP-IB data bus are the 8-bit data of port 2 displayed in decimal notation with $P2_0$ as LSB and $P2_7$ as MSB. Given below is the relationship between the input signal of port 2 and the output data.

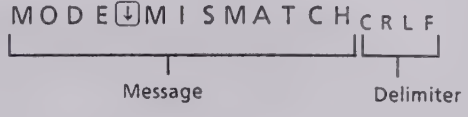
Input signal								Output data
$P2_7$	$P2_6$	$P2_5$	$P2_4$	$P2_3$	$P2_2$	$P2_1$	$P2_0$	
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	1	1
				to				to
1	1	1	1	1	1	1	0	254
1	1	1	1	1	1	1	1	255

0 : LOW (= 0 V) 1 : HIGH (= + 5 V)

The data is output in 7-bit ASCII code with EOI and LF sent out simultaneously as delimiters. The output format is as follows :



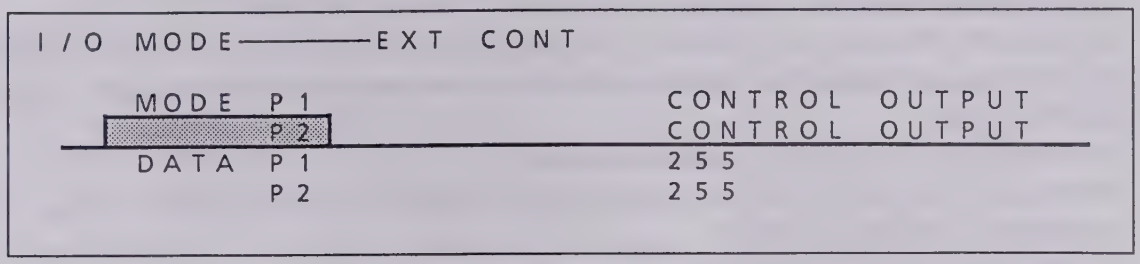
If port 2 is not in the data read mode, the following error message is sent out at the time the analyzer is assigned as a talker.

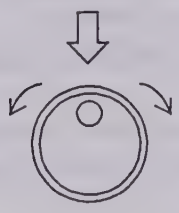


(4) Operation procedure

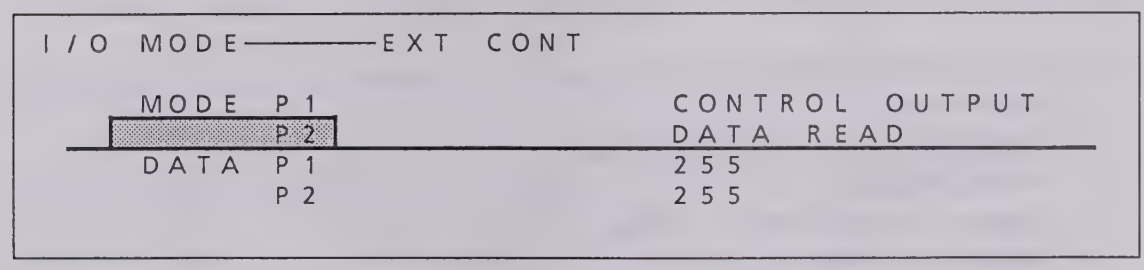
Set the port 2 in the data read mode. Then specify 32 for the talker mode of the analyzer on the GP-IB controller Assigning the analyzer as a talker on the controller sends out the data currently applied to $P2_0$ to $P2_7$.

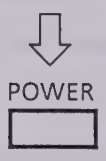
Example 7-7) Data read operation



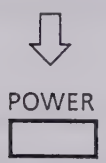


Rotate jog dial / shuttle ring ⑥ to display DATA READ.





Turn the power once off and then on again.



Connect the signal to be read to $P2_0$ to $P2_7$ of the EXT CONTROL I/O connector.

Connect the analyzer and the GP-IB interface of the controller (computer).

Sends program code "TM 32" from the controller to the analyzer.

Assign the analyzer as a talker on the controller. The data then applied to $P2_0$ to $P2_7$ are sent out to the controller.

7-11 DATA PRINT FUNCTION

(1) General description of the function

Via the EXT CONTROL I/O interface, the analyzer can output to the Centronics equivalent printer the measured value of the specified memory address during the auto sequence operation of the preset memory.

(2) Specifying the memory address for data printing

Specify using the panel keys the memory address where the measured value is to be printed out during auto sequence operation.

(a) Displaying the auto sequence mode setup screen

The memory address specified to be printed out is displayed on the auto sequence mode setup screen.

Press the F6 key with the initial menu on screen to display the I/O mode menu screen. If the screen other than the initial menu is being displayed, press the EXIT key to bring the initial menu on screen and then press the F6 key.

Pressing the F3 key with the I/O mode menu on screen displays the AUTO SEQUENCE MODE screen. An example operation is shown in Example 7-8.

The AUTO SEQUENCE MODE setup screen contains the following:

① Mode display
Displays the mode for auto sequence.

② Address display
Displays the preset memory address.

③ Interval time display
Displays the interval time during the auto sequence operation of the memory address currently displayed in the address display.

④ Print address display
Indicates the print specification status of the memory address currently displayed in the address display.

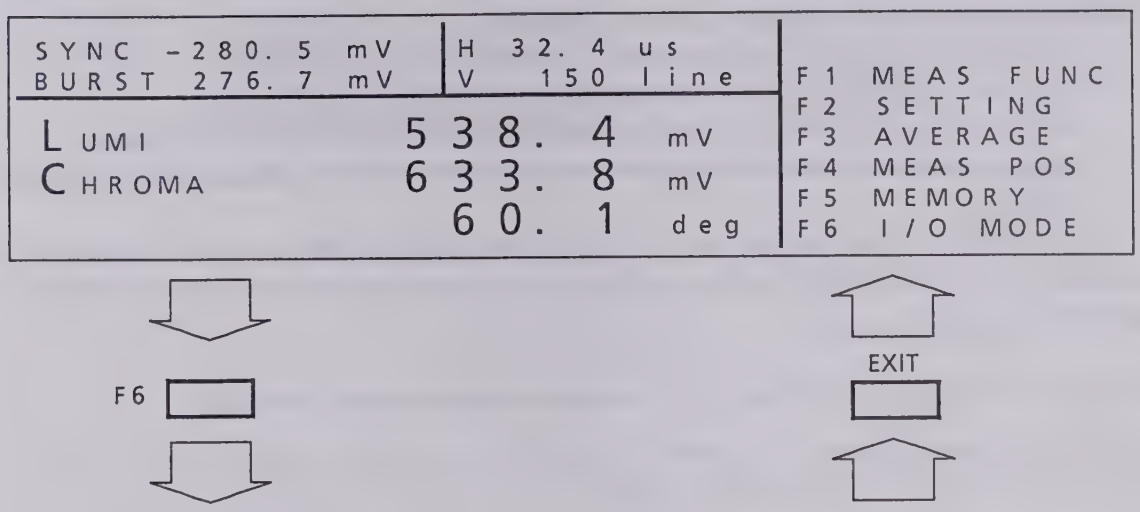
Press the NEXT key with the AUTO SEQUENCE MODE setup screen displayed. Now the mode display field, address display field, interval time display field, and print address display field are sequentially displayed in reverse video indicating that the field is ready to accept setting data.

The print specification status appears as follows in the print address display field:

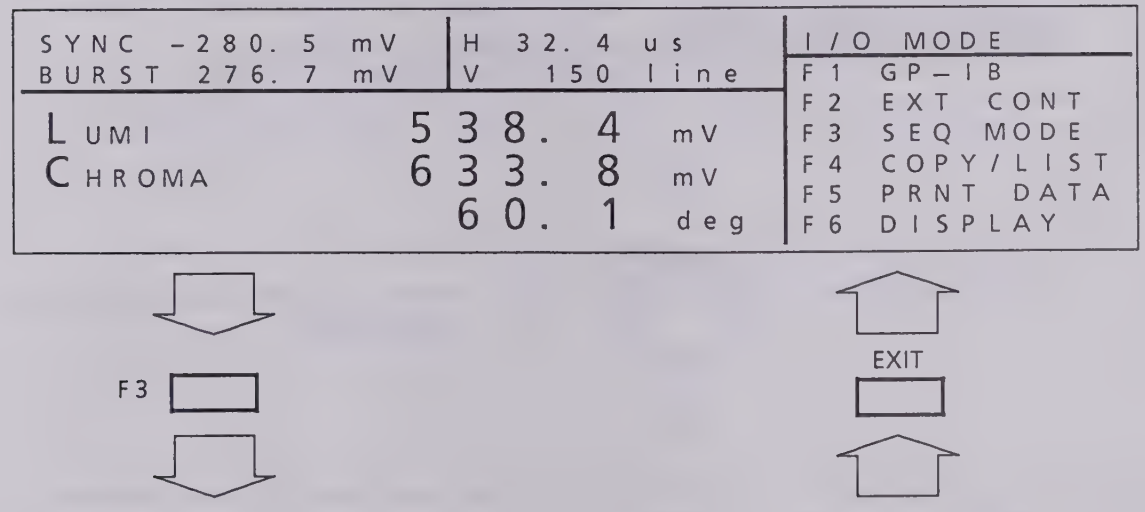
NO PRINT	Printing canceled.
PRINT	Printing specified.

Example 7-8) Displaying AUTO SEQUENCE MODE setup screen

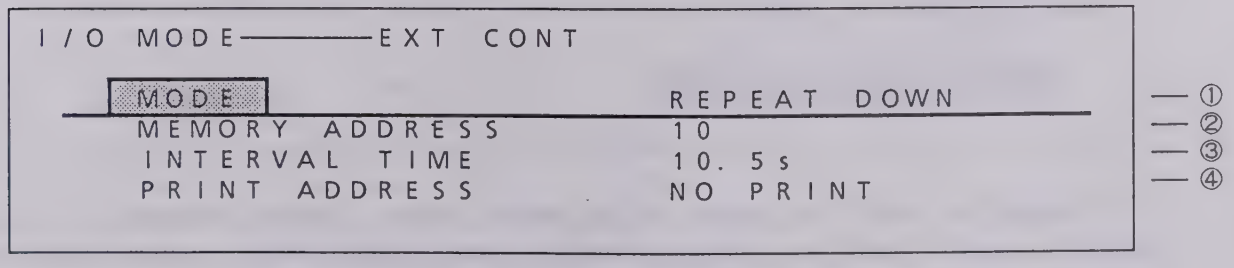
Initial menu



I/O mode menu screen



AUTO SEQUENCE MODE setup screen



①: Mode display
②: Address display
③: Interval time display
④: Print address display

(b) Setup operation

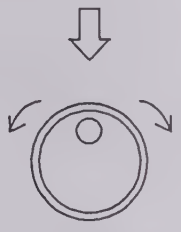
Display the AUTO SEQUENCE MODE setup screen and press the NEXT key to select the print address display field. Now the print address can be specified or canceled. The following four methods are available for specifying the print address.

- Specify or cancel printing of the memory address currently displayed.
- Specify or cancel printing of a desired address.
- Specify or cancel printing of all the addresses between the desired two addresses.
- Specify or cancel all the addresses between the start and end addresses of the sequential recalling.

The operation procedure for each of the above four methods are given below. In the examples, it is assumed that the start address of the preset memory is set to 00 and the end address is set to 19.

Example 7-9) Specify the printing of the memory address currently displayed

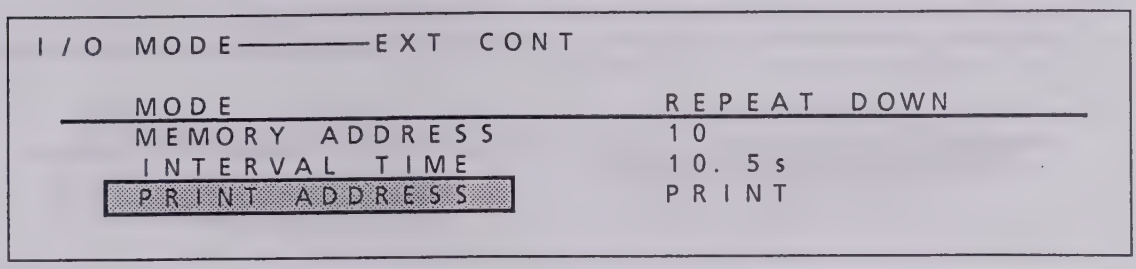
```
I/O MODE ———— SEQ MODE

     MODE                    REPEAT DOWN
     MEMORY ADDRESS          10
     INTERVAL TIME           10.5s
     PRINT ADDRESS           NO PRINT
```

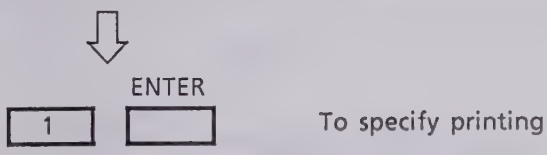


Rotate jog dial/shuttle ring ⑥ to display PRINT.

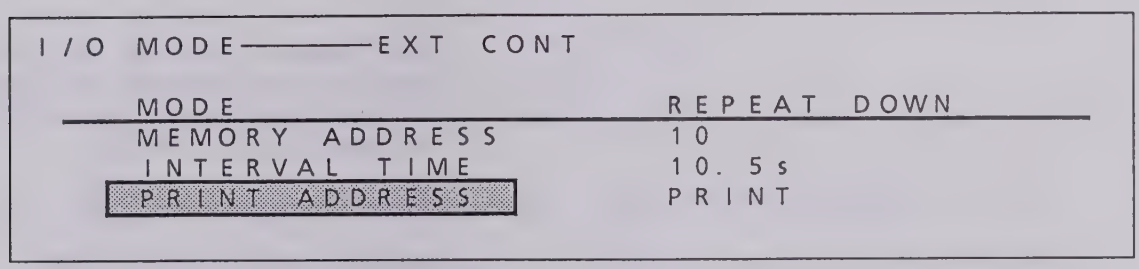
```
I/O MODE ———— SEQ MODE

     MODE                    REPEAT DOWN
     MEMORY ADDRESS          10
     INTERVAL TIME           10.5s
     PRINT ADDRESS           PRINT
```

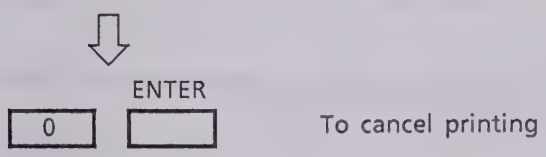
To specify or cancel the printing of the memory address currently displayed, it is also possible to press the NEXT key to display the print address display field in reverse video and use the numeric keys and then the ENTER key.





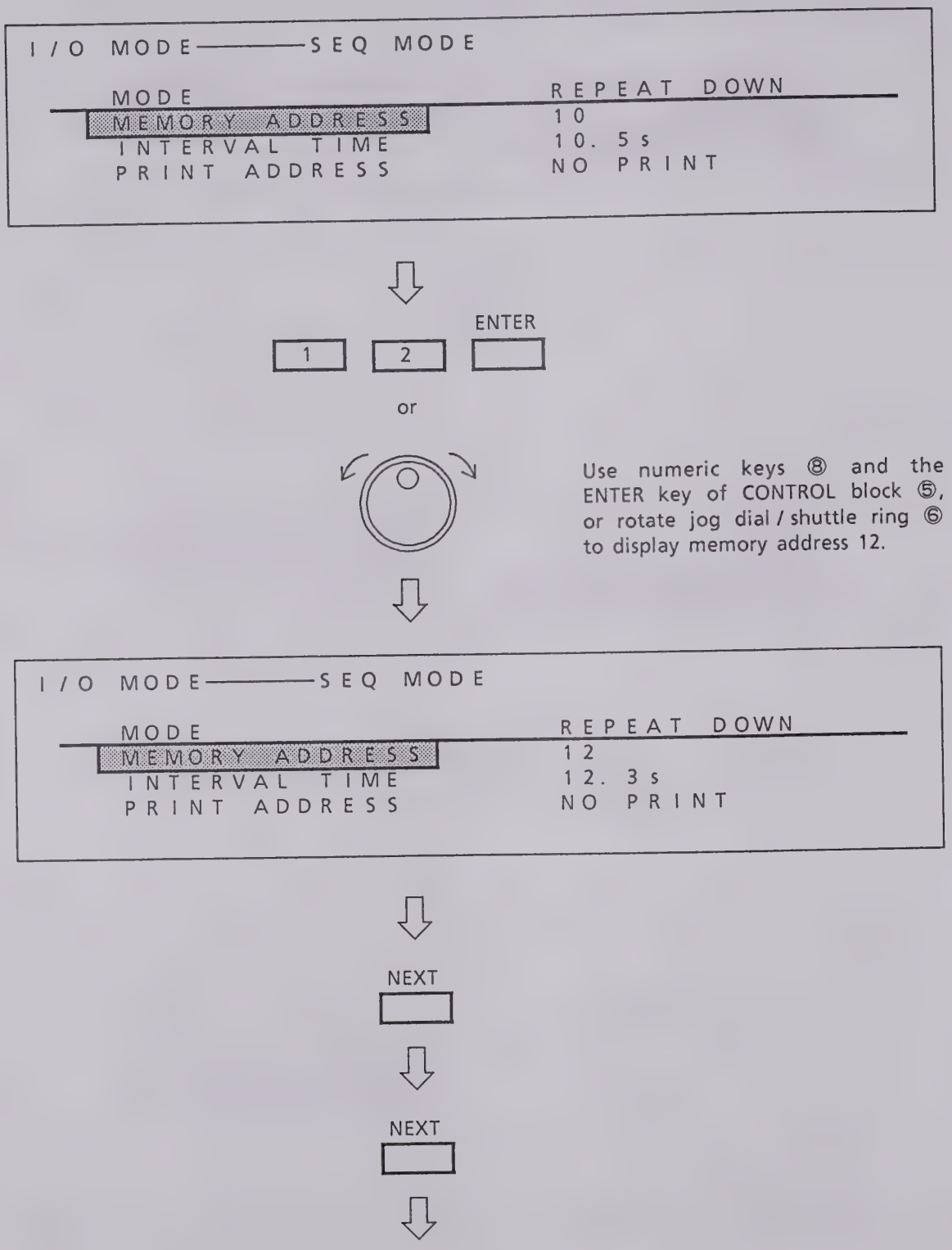
To specify printing





To cancel printing

Example 7-10) To specify the printing of memory address 12



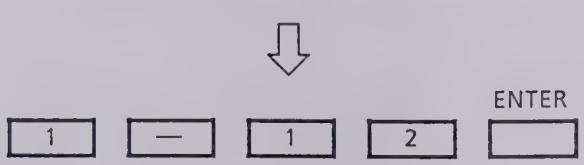
```
I/O MODE ———— SEQ MODE

MODE                    REPEAT DOWN
MEMORY ADDRESS          12
INTERVAL TIME           12.3s
PRINT ADDRESS           NO PRINT
```

Rotate jog dial / shuttle ring ⑥ to display PRINT for address 12.

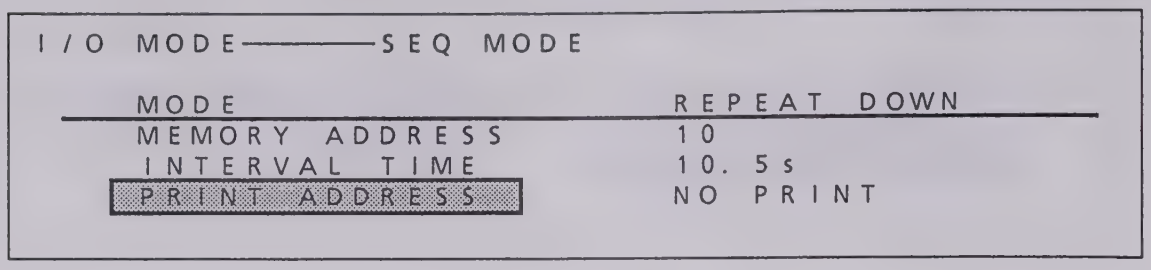
```
I/O MODE ———— SEQ MODE

MODE                    REPEAT DOWN
MEMORY ADDRESS          12
INTERVAL TIME           12.3s
PRINT ADDRESS           PRINT
```

To specify or cancel a desired address, it is also possible to press the NEXT key to display the print address display field in reverse video and then use the numeric keys and the ENTER key.

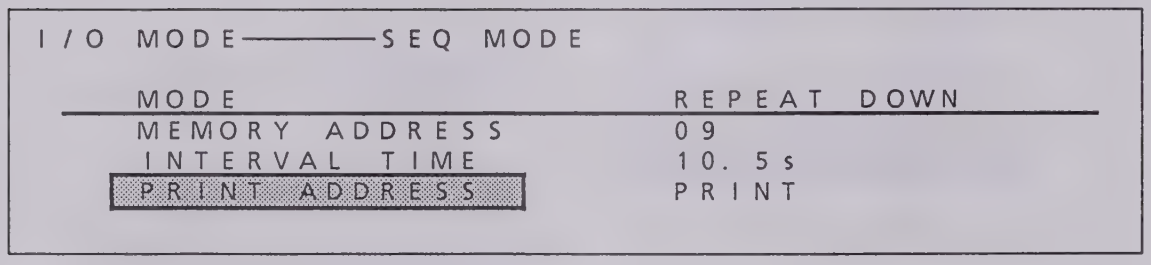
```
I/O MODE ———— EXT CONT

MODE                    REPEAT DOWN
MEMORY ADDRESS          12
INTERVAL TIME           12.3s
PRINT ADDRESS           PRINT
```

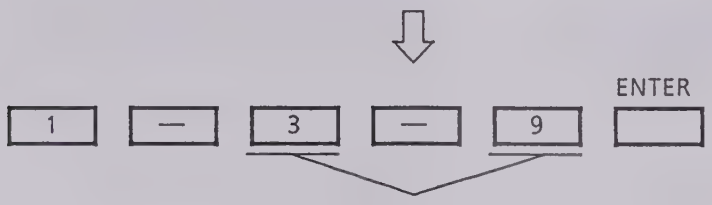


Example 7-11) Specify the printing of memory addresses 3 to 9



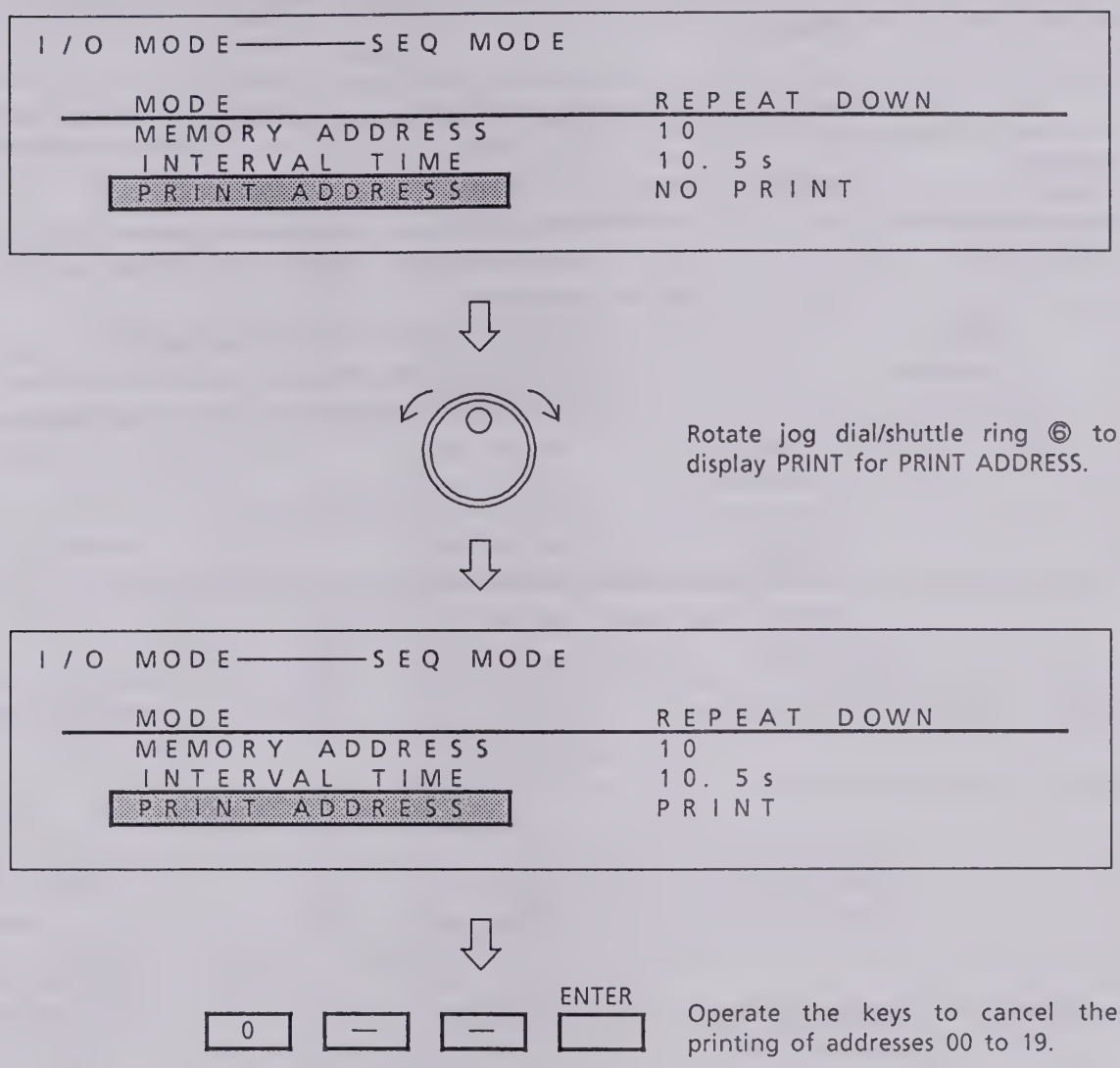
Rotate jog dial/shuttle ring ⑥ to display PRINT for PRINT ADDRESS.





Operate the keys to specify the printing of addresses 3 to 9.

Example 7-12) To cancel the printing of all the addresses from the start to the end



(3) Printing of the current measurement value

The current measurement values can be output to the printer regardless of the auto sequence operation.

First, set the printer output mode for port 1, and press the PRNT DATA key (F5 key) on the I/O mode menu screen to output the current measurement values to the printer.

(4) GP-IB program code

Specification of the print addresses and selection of the print mode for data printing can be controlled through the GP-IB.

Table 7-2 The GP-IB program code for data printing

Header code	Data code	Description
PA	pa	Specifies / cancels printing of the address currently displayed.
	pa – a_1	Specifies / cancels printing of address a_1.
	pa – a_2 – a_3	Specifies / cancels printing of addresses a_2 to a_3.
	pa – –	Specifies / cancels printing of start to end addresses.
	pa : Cancel 0 / Specify 1 a_1, a_2, a_3 : Addresses 00 to 31 ($a_2 < a_3$)	

THE GP-IB PROGRAM CODE LIST

Item	Header code	Data code	Description
Measurement function	MM	1	Y & C measurement
		2	Y measurement
		3	PEAK-PEAK measurement
		4	+ PEAK measurement
		5	– PEAK measurement
		6	AC PEAK measurement
System	MD	0	Sets the NTSC system
		1	Sets the PAL system
Measurement unit	UN	1	Sets the mV unit
		2	Sets the IRE unit
Input connector	CH	1	Sets the input connector to FRONT
		2	Sets the input connector to REAR 1
		3	Sets the input connector to REAR 2
		4	Sets the input connector to REAR Y / C
Input impedance	TR	0	Sets 75 Ω for the impedance of the input connector currently selected.
		1	Sets high impedance for the input connector currently selected.
Input signal polarity	PL	0	Sets negative polarity for input signal.
		1	Sets positive polarity for input signal.
Internal sync / External sync	IN	0	Sets internal sync.
		1	Sets external sync with input impedance of sync signal at 75 Ω.
		2	Sets external sync with high input impedance.
Measuring period	CM	1	Sets measurement period to 1 field.
		2	Sets measurement period to 2 fields.
		3	Sets measurement period to 4 fields.
Input range	GN	1	Sets input range to 570 mV / 79.8 IRE (NTSC) / 57.0 IRE (PAL).
		2	Sets input range to 620 mV / 86.8 IRE (NTSC) / 62.0 IRE (PAL).
		3	Sets input range to 670 mV / 93.8 IRE (NTSC) / 67.0 IRE (PAL).
		4	Sets input range to 730 mV / 102.2 IRE (NTSC) / 73.0 IRE (PAL).
		5	Sets input range to 800 mV / 112.0 IRE (NTSC) / 80.0 IRE (PAL).
		6	Sets input range to 890 mV / 124.6 IRE (NTSC) / 89.0 IRE (PAL).
		7	Sets input range to 1000 mV / 140.0 IRE (NTSC) / 100.0 IRE (PAL).
		8	Sets input range to 1140 mV / 159.6 IRE (NTSC) / 114.0 IRE (PAL).
		9	Sets input range to 1300 mV / 182.0 IRE (NTSC) / 130.0 IRE (PAL).
		10	Sets input range to 1600 mV / 224.0 IRE (NTSC) / 160.0 IRE (PAL).

THE GP-IB PROGRAM CODE LIST (Cont'd)

Item	Header code	Data code	Description
Offset	OS	–300 to 720 –39.2 to 100.8 –30.0 to 70.0	Sets offset. (mV) Sets offse. (IRE / NTSC) Sets offse. (IRE / PAL)
Number of times of summation average	SC	1, 2, 4, 8, 16, 32, 64	Sets number of times of summation average.
Number of times of summation average	AH	1, 2, 4, 8, 16, 32, 64	Sets number of lines of summation average.
Sync measurement position	SY	0.7 to 64.0	Sets SYNC level measurement position. (0.7 to 64 μs)
Burst measurement position	BU	0.7 to 64.0	Sets burst level measurement position. (0.7 to 64 μs)
Reset position	RS	h, v h : 0.7 to 64.0 v : 1 to 1250	Sets reset position h : H position 0.7 to 64 μs v : V position Line 1 to line 1250
Reference position	RF	h, v h : 0.7 to 64.0 v : 1 to 1250	Sets reference position h : H position 2.7 to 64 μs v : V position Line 1 to line 1250
Sample position	MS	h, v h : 0.7 to 64.0 v : 1 to 1250	Sets sample position h : H position 0.7 to 64 μs v : V position Line 1 to line 1250
Measurement start	GO	0 1 2	Stops measurement. Starts single measurement. Starts repeat measurement.
Marker registration	MK	1 to 256	Register current measurement position with specified number.
Marker deletion	DE	1 to 256 0	Deletes marker with specified number. Deletes all markers.
Marker shift	SN	1 to 256	Shifts measurement position to specified marker number position.
Service request	SR	0 1	Disables service request capability. Enables service request capability. (Service request is enabled for talker nodes 1 to 31.)

THE GP-IB PROGRAM CODE LIST (Cont'd)

Item	Header code	Data code	Description
LCD and monitor display control	DS	0	Terminates LCD and monitor display.
		1	Enables LCD display only.
		2	Enables monitor display only.
		3	Enables both LCD and monitor displays.
Marker measurement specification	MX	1	Makes measurement at current measuring position.
		2	Makes measurement at registered marker.
	TX	1 to 256	Specifies marker for sending out measured data. (Two or more markers can be set at a time by delimiting with commas (,). Markers must always be set for marker measurement.)
		0	Cancels specification of all markers for sending out measured data.
Preset memory	RC	00 to 31	Recalls preset memory addresses 00 to 31.
	ST	00 to 31	Stores in preset memory addresses 00 to 31.
Measurement at two or more points	AX	0	Outputs the measured values at the registered markers.
		1	Outputs the measured maximum value.
		2	Outputs the measured minimum value.
		3	Outputs the measured maximum and minimum values.
		4	Outputs the average value of the measured maximum and minimum values.
PAL ±V measurement	PV	0	Outputs the measured value which is not distinguish between phase A and B.
		1	Outputs the measured value of phase A.
		2	Outputs the measured value of phase B.
		3	Outputs the difference between the measured values of phase A and B.
		4	Outputs the average value of the measured values of phase A and B.
		5	Outputs the measured values of phase A and B, and their difference.

THE GP-IB PROGRAM CODE LIST (Cont'd)

Item	Header code	Data code	Description
Auto sequence	AS	0	Sets REPEAT UP for auto sequence operation mode.
		1	Sets SINGLE UP for auto sequence operation mode.
		2	Sets REPEAT DOWN for auto sequence operation mode.
		3	Sets SINGLE DOWN for auto sequence operation mode.
	NT	t	Sets t (s) for interval time of the address currently displayed.
		t – a_1	Sets t (s) for interval time of address a_1.
		t – a_2 – a_3	Sets t (s) for interval time of addresses a_2 to a_3.
		t – –	Sets t (s) for interval time of the start to end addresses.
			t : Interval time 0.1 to 99.9
			a_1, a_2, a_3 : Addresses 00 to 31 ($a_2 < a_3$)
Control output signal	P 1 or P 2	B00000000 to B11111111	Sets control output for port 1 or port 2. Sets in binary data.
		H00 to HFF	Sets hexadecimal data.
		D0 to D255	Sets in decimal data.
		S0 to S7	Sets (to 1) specified bit.
		R0 to R7	Resets (to 0) specified bit.
Data print	PA	pa	Specifies / cancels printing of the address currently displayed.
		pa – a_1	Specified / cancels printing of address a_1.
		pa – a_2 – a_3	Specified / cancels printing of addresses a_2 to a_3.
		pa – –	Specified / cancels printing from the start to end addresses.
			pa : Cancel 0 / Specify 1
			a_1, a_2, a_3 : Addresses 00 to 31 ($a_2 < a_3$)

THE GP-IB PROGRAM CODE LIST (Cont'd)

Item	Header code	Data code	Description
Talker mode	TM	0	Sends out setup state of VP-8450A.
		1	SYNC level
		2	Burst level
		3	SYNC level, burst level
		4	Luminance level
		5	SYNC level, luminance level
		6	Burst level, luminance level
		7	SYNC level, burst level, luminance level
		8	Chrominance level
		9	SYNC level, chrominance level
		10	Burst level, chrominance level
		11	SYNC level, burst level, chrominance level
		12	Luminance level, chrominance level
		13	SYNC level, luminance level, chrominance level
		14	Burst level, luminance level, chrominance level
		15	SYNC level, burst level, luminance level, chrominance level
		16	Phase
		17	SYNC level, phase
		18	Burst level, phase
		19	SYNC level, burst level, phase
		20	Luminance level, phase
		21	SYNC level, luminance level, phase
		22	Burst level, luminance level, phase
		23	SYNC level, burst level, luminance level, phase
		24	Chrominance level, phase
		25	SYNC level, chrominance level, phase
		26	Burst level, chrominance level, phase
		27	SYNC level, burst level, chrominance level, phase
		28	Luminance level, chrominance level, phase
		29	SYNC level, luminance level, chrominance level, phase
		30	Burst level, luminance level, chrominance level, phase
		31	SYNC level, burst level, luminance level, chrominance level, phase
		32	Sends out data applied to port 2.
		33	Sends out input signal state.

GP-IB sample program Example 1

1. A principal measurement function

Y & C measurement

Executes the single measurement of luminance level, chrominance level and chrominance phase is NTSC system, and outputs the measured values through GP-IB.

```
10 '    ******************************************************
20 '    *                                                    *
30 '    *        GPIB  TEST  PROGRAM  FOR  VP-8450A          *
40 '    *                                                    *
50 '    *                                                    *
60 '    ******************************************************
70 '
80 '
90 '    ******************************************************
100 '   * initial set                                        *
110 '   *          VP-8450A address          15              *
120 '   *          delimiter                 0D+0A           *
130 '   *          GP-IB timeout             off             *
140 '   ******************************************************
150 '
160     ADDR = 15
170     ISET IFC  : ISET REN
180     CMD DELIM = 0    : CMD TIMEOUT = 0
190 '
200 '   ******************************************************
210 '   * VP-8450A setup                                     *
220 '   *          MEAS FUNC                 Y&C             *
230 '   *          SETTING     SYSTEM        NTSC            *
240 '   *                      INPUT         REAR 1          *
250 '   *                      IMPEDANCE     75 ohm          *
260 '   *                      POLARITY      SYNC NEGATIVE   *
270 '   *                      SYNC          INT             *
280 '   *                      SMPL MODE     1 FIELD         *
290 '   *                      RANGE FS      1000 mV         *
300 '   *                      OFFSET        0 mV            *
310 '   *          AVERAGE     NUMBER        1               *
320 '   *                      LINE          1               *
330 '   *          MEAS POS    SYNC          2.4 us          *
340 '   *                      BURST         6.6 us          *
350 '   *                      MEAS  H       37.5 us         *
360 '   *                            V       150 line        *
370 '   ******************************************************
380 '
390     SEND.D$ = "DE0"                                          : GOSUB *DATA.SEND
400     SEND.D$ = "MM1 MD0 CH2 TR0 PL0 IN0 CM1 GN7 OS0"          : GOSUB *DATA.SEND
410     SEND.D$ = "SC1 AH1 MS37.5,150 SY2.4 BU6.6"               : GOSUB *DATA.SEND
420     SEND.D$ = "DS0"                                          : GOSUB *DATA.SEND
430     SEND.D$ = "TM28"                                         : GOSUB *DATA.SEND
440 '
```

```
445  *MEAS
470     SEND.D$ = "GO 1"                    : GOSUB *DATA.SEND
480     GOSUB *DATA.RECEIVE
495     GOTO *MEAS
500 '
510 '     ************************************
520 '     *          LISTENER/TALKER           *
530 '     ************************************
540 '
550 '               LISTENER/TALKER COMMAND
560 '
570     *DATA.SEND
580           PRINT@ ADDR ; SEND.D$
590           RETURN
600 '
610     *DATA.RECEIVE
620           LINE INPUT@ ADDR ; RECEIVE.D$
630           RETURN
640 '
```

Line 390 : Deletes all the markers.

400, 410 : Sets measurement conditions.

420 : Turns of MONITOR/LCD indication.

430 : Selects a talker mode

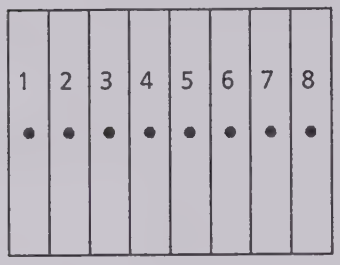
- luminance level
- chrominance level
- phase

470 : Starts the measurement

GP-IB sample program Example 2

2. Measurement of summation average, maximum and minimum values over multiple points.

CRT display



Registers eight markers as shown on the left, and executes following measurement:

1) Summation average
2) Maximum value
3) Minimum value

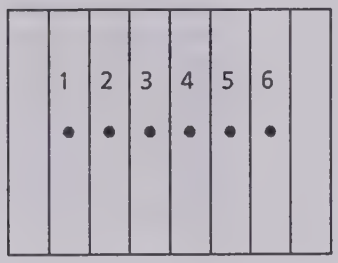
```
10 '    ********************************************************
20 '    *                                                      *
30 '    *          GPIB  TEST  PROGRAM  FOR  VP-8450A          *
40 '    *                                                      *
50 '    *                                                      *
60 '    ********************************************************
70 '
80 '
90 '    ********************************************************
100 '   * initial set                                          *
110 '   *          VP-8450A address              15            *
120 '   *          delimiter                     0D + 0A       *
130 '   *          GP-IB timeout                 off           *
140 '   ********************************************************
150 '
160     ADDR = 15
170     ISET IFC                : ISET REN
180     CMD DELIM = 0           : CMD TIMEOUT = 0
190 '
200 '   ********************************************************
210 '   * VP-8450A setup                                       *
220 '   *          MEAS FUNC                     Y&C           *
230 '   *          SETTING     SYSTEM            NTSC          *
240 '   *                      INPUT             REAR 1        *
250 '   *                      IMPEDANCE         75 ohm        *
260 '   *                      POLARITY          SYNC NEGATIVE *
270 '   *                      SYNC              INT           *
280 '   *                      SMPL MODE         1 FIELD       *
290 '   *                      RANGE FS          1000 mV       *
300 '   *                      OFFSET            0 mV          *
310 '   *          AVERAGE     NUMBER            1             *
320 '   *                      LINE              1             *
330 '   *          MEAS POS    SYNC              2.4 us        *
340 '   *                      BURST             6.6 us        *
350 '   *                      MEAS  H           37.5 us       *
360 '   *                            V           150 line      *
370 '   ********************************************************
380 '
```

```
390     SEND.D$ = "DE0"                                          : GOSUB *DATA.SEND
400     SEND.D$ = "MM1 MD0 CH2 TR0 PL0 IN0 CM1 GN7 OS0"          : GOSUB *DATA.SEND
410     SEND.D$ = "SC1 AH1 MS37.5,150 SY2.4 BU6.6"               : GOSUB *DATA.SEND
411     SEND.D$ = "MS12.5 MK1"                                   : GOSUB *DATA.SEND
412     SEND.D$ = "MS18.5 MK2"                                   : GOSUB *DATA.SEND
413     SEND.D$ = "MS25.0 MK3"                                   : GOSUB *DATA.SEND
414     SEND.D$ = "MS31.5 MK4"                                   : GOSUB *DATA.SEND
415     SEND.D$ = "MS38.2 MK5"                                   : GOSUB *DATA.SEND
416     SEND.D$ = "MS44.5 MK6"                                   : GOSUB *DATA.SEND
417     SEND.D$ = "MS51.2 MK7"                                   : GOSUB *DATA.SEND
418     SEND.D$ = "MS57.5 MK8"                                   : GOSUB *DATA.SEND
419     SEND.D$ = "MX2"                                          : GOSUB *DATA.SEND
420     SEND.D$ = "TX0,1,2,3,4,5,6,7,8"                          : GOSUB *DATA.SEND
425     SEND.D$ = "DS0"                                          : GOSUB *DATA.SEND
430     SEND.D$ = "TM4"
440     CLS
445 *MEAS
470     SEND.D& = "AX0 GO1"   : GOSUB *DATA.SEND
475     GOSUB *DATA.RECEIVE   : LOCATE 10,5 : PRINT RECEIVE.D$
480     SEND.D& = "AX1"       : GOSUB *DATA.SEND
485     GOSUB *DATA.RECEIVE   : LOCATE 10,7 : PRINT " MAX  " ; RECEIVE.D$
487     SEND.D& = "AX2"       : GOSUB *DATA.SEND
488     GOSUB *DATA.RECEIVE   : LOCATE 10,8 : PRINT " MIN  " ; RECEIVE.D$
490     SEND.D& = "AX4"       : GOSUB *DATA.SEND
492     GOSUB *DATA.RECEIVE   : LOCATE 10,9 : PRINT " AVE  " ; RECEIVE.D$
495     GOTO *MEAS
500 '
510 '     ************************************
520 '     *          LISTENER/TALKER         *
530 '     ************************************
540 '
550 '               LISTENER/TALKER COMMAND
560 '
570     *DATA.SEND
580             PRINT@ ADDR ; SEND.D$
590             RETURN
600 '
610     *DATA.RECEIVE
620             LINE INPUT@ ADDR ; RECEIVE.D$
630             RETURN
640 '
```

Line 411 to 418 : Registers eight markers. (marker 1 to 8)
419 : Sets to the multiple measurement mode.
420 : Sets the measurement points.
430 : Selects a talker mode. (luminance level)
470 : Executes normal measurement.
480 : Measures maximum value
487 : Measures minimum value
490 : Measures summation average.

3. PAL +V, −V measurement

CRT display



Registers six markers as shown on the left, and executes following measurement:

1) +V
2) −V
3) Difference between +V and −V
4) Summation average of +V and −V

```
100 '   ****************************************************
110 '   *                                                  *
120 '   *        GPIB  TEST  PROGRAM  FOR  VP-8450A        *
130 '   *                                                  *
140 '   *                                                  *
150 '   ****************************************************
160 '
170 '
180 '   ****************************************************
190 '   * initial set                                      *
200 '   *          VP-8450A address          15            *
210 '   *          delimiter                 0D+0A         *
220 '   *          GP-IB timeout             off           *
230 '   ****************************************************
240 '
250     ADDR = 15
260     ISET IFC                : ISET REN
270     CMD DELIM = 0           : CMD TIMEOUT = 0
280 '
290 '   ****************************************************
300 '   * VP-8450A setup                                   *
310 '   *          MEAS FUNC                 Y&C           *
320 '   *          SETTING    SYSTEM         PAL           *
330 '   *                     INPUT          REAR1         *
340 '   *                     IMPEDANCE      75 ohm        *
350 '   *                     POLARITY       SYNC NEGATIVE *
360 '   *                     SYNC           INT           *
370 '   *                     SMPL MODE      1 FIELD       *
380 '   *                     RANGE FS       1000 mV       *
390 '   *                     OFFSET         0 mV          *
400 '   *          AVERAGE    NUMBER         1             *
410 '   *                     LINE           1             *
420 '   *          MEAS POS   SYNC           2.4 us        *
430 '   *                     BURST          6.6 us        *
440 '   *                     MEAS  H        37.5 us       *
450 '   *                           V        150 line      *
460 '   ****************************************************
470 '
480     SEND.D$ = "DE0"                                          :GOSUB *DATA.SEND
490     SEND.D$ = "MM1 MD1 CH2 TR0 PL0 IN0 CM1 GN7 OS0"          :GOSUB *DATA.SEND
500     SEND.D$ = "SC1 AH1 MS37.5,150 SY2.4 BU6.6"               :GOSUB *DATA.SEND
510     SEND.D$ = "MS19.5 MK1"                                   :GOSUB *DATA.SEND
```

```
520     SEND.D$ = "MS26.5 MK2"                                  :GOSUB *DATA.SEND
530     SEND.D$ = "MS32.2 MK3"                                  :GOSUB *DATA.SEND
540     SEND.D$ = "MS39.5 MK4"                                  :GOSUB *DATA.SEND
550     SEND.D$ = "MS45.5 MK5"                                  :GOSUB *DATA.SEND
560     SEND.D$ = "MS51.5 MK6"                                  :GOSUB *DATA.SEND
570     SEND.D$ = "MX2"                                         :GOSUB *DATA.SEND
580     SEND.D$ = "TX0,1,2,3,4,5,6"                             :GOSUB *DATA.SEND
590     SEND.D$ = "DS0"                                         :GOSUB *DATA.SEND
600     SEND.D$ = "TM16"                                        :GOSUB *DATA.SEND
610     CLS
620 '
630     LOCATE 10,3 :PRINT "POS"
640     RESTORE *POS.DAT
650     FOR I=1 TO 6
660             READ DAT$
670             LOCATE (I-1)*8+17,3
680             PRINT DAT$
690     NEXT I
700 '
710 *MEAS
720     SEND.D& = "PV0 GO1"     :GOSUB *DATA.SEND
730     GOSUB *DATA.RECEIVE     :LOCATE 10,5 :PRINT "NORM  ";RECEIVE.D$
740     SEND.D& = "PV1"         :GOSUB *DATA.SEND
750     GOSUB *DATA.RECEIVE     :LOCATE 10,7 :PRINT "  +V  ";RECEIVE.D$
760     SEND.D& = "PV2"         :GOSUB *DATA.SEND
770     GOSUB *DATA.RECEIVE     :LOCATE 10,8 :PRINT "  -V  ";RECEIVE.D$
780     SEND.D& = "PV3"         :GOSUB *DATA.SEND
790     GOSUB *DATA.RECEIVE     :LOCATE 10,9 :PRINT "DIF   ";RECEIVE.D$
800     SEND.D& = "PV4"         :GOSUB *DATA.SEND
810     GOSUB *DATA.RECEIVE     :LOCATE 10,10 :PRINT "AVE  ";RECEIVE.D$
820     GOTO *MEAS
830 '
840 '   ************************************
850 '   *          LISTENER/TALKER         *
860 '   ************************************
870 '
880 '               LISTENER/TALKER COMMAND
890 '
900   *DATA.SEND
910           PRINT@ ADDR ; SEND.D$
920           RETURN
930 '
940   *DATA.RECEIVE
950           LINE INPUT@ ADDR ; RECEIVE.D$
960           RETURN
970 '
980 *POS.DAT
990     DATA "19.5","26.5","32.2","39.5","45.5","51.5"
```

Line 510 to 560 : Registers six markers. (marker 1 to 6)

580 : Sets to the multiple measurement mode.

600 : Selects a talker mode (phase)

730 : Executes normal measurement.

750 : Measures +V.

770 : Measures −V.

790 : Measures difference between +V and −V.

810 Measures summation average of +V and −V.

PARTS LIST

• 4G208617	P8450A OVERALL	8-2
• 4G208618	P8450A DIGITAL	8-3
• 4G208619	P8450A ANALOG	8-13
• 4G208620	P8450A PANEL	8-35
• 4G208621	P8450A REMOTE	8-36
• 4G208679	P8450A LCD ASSY	8-37
• 4G208680	P8450A CABLE	8-37
• 4G208681	P8450A FAN ASSY	8-38
• 4G208682	P8450A REAR PAN	8-38
• 4G208683	P8450A ACCESSOR	8-39
• 4G305773	P8450A CABINET	8-39
• 4G305774	P8450A MECHA	8-40
• 4G305775	P8450A PACKAGE	8-41

P8450A OVERALL DWG NO 4G208617

REF NO	QTY	PARTS NO	DESCRIPTION	
A 0001	1	P15E-5-NXMCI	POWER SUPPLY	5V/3A
A 0002	1	PMC50E2XULAN	POWER SUPPLY	+5V5A +15V1.2A -15V
F 0001	1	DUH1.6AT	FUSE : UL,DENTORI	1.6A 250V 20MM
W 0002	1	BNC216	CONNECTOR	BNC
XF	1	FEK031.1663	FUSE HOLDER CAP	5X20MM FUSE

P8450A DIGITAL DWG NO 4G208618

REF NO	QTY	PARTS NO	DESCRIPTION	
. 0003	1	4G481521-2	ROM:PROG 1	P8450A
. 0004	1	4G481522-2	ROM:PROG 2	P8450A
. 0005	1	4G481523-2	ROM:PROG 3	P8450A
. 0036	1	4G481524	ROM:SELECTOR 1	P8450A
. 0055	1	4G481525	ROM:SELECTOR 2	P8450A
. 0060	1	4G481526	ROM:SELECTOR 3	P8450A
. 0072	1	4G481527	ROM:SELECTOR 4	P8450A
A 0001	1	N105-05-5	EL INVERTER	DC5V AC130V MAX
BT 0001	1	GB50-3FA1	BATTERY:NI-CAD	3.6V 50MAH
C 0001	1	ECEA1CU101	C:FXD AL ELECT	100UF +-20% 16V
C 0002	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0003	1	ECEA1CU101	C:FXD AL ELECT	100UF +-20% 16V
C 0004	1	ECEA1CU470	C:FXD AL ELECT	47UF +-20% 16V
C 0005	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0006	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0008	1	ECEA1CU101	C:FXD AL ELECT	100UF +-20% 16V
C 0009	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0010	1	ECEA1HU010	C:FXD AL ELECT	1UF +-20% 50V
C 0011	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0012	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0013	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0014	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0015	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0016	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0017	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0018	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0019	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0020	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0021	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0022	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0023	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0024	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0025	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0026	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0027	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0028	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0029	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0030	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0031	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0032	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V

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REF NO	QTY	PARTS NO	DESCRIPTION	
C 0033	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0034	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0035	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0036	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0037	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0038	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0039	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0040	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0041	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0042	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0043	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0044	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0045	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0046	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0047	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0048	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0049	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0050	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0051	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0052	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0053	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0054	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0055	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0056	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0057	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0058	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0059	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0060	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0061	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0062	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0063	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0064	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0065	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0066	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0067	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0068	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0069	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0070	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0071	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0072	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0073	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0074	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V

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REF NO	QTY	PARTS NO	DESCRIPTION	
C 0075	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0076	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0077	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0078	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0079	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0080	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0081	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0082	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0083	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0084	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0085	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0086	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0087	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0088	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0089	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0090	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0091	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0092	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0093	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0094	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0095	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0096	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0097	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0098	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0099	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0100	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0101	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0102	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0103	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0104	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0105	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0106	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0107	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0108	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0109	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0110	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0111	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0112	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0113	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0114	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0115	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0116	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V

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REF NO	QTY	PARTS NO	DESCRIPTION	
C 0117	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0118	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0119	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0120	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0121	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0122	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0123	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0124	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0125	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0126	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0127	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0128	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0129	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0130	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0131	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0132	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0133	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0134	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0135	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0136	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0137	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0138	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0139	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0140	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0141	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0142	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
CR 0001	1	1SS101	DIODE:SI SCHOTTKY	15MA 70V
E	1	2G401828	PCB,DIGITAL	P8450A
E	1	4G401346	PC BOARD	P7684A BATTERY
J 0001	1	SLEM30S-2	CONNECTOR:ZIFLO	30P STRAIGHT
J 0002	1	SLEM30S-2	CONNECTOR:ZIFLO	30P STRAIGHT
J 0003	1	EMCS0252M	CONNECTOR PIN	2P STRAIGHT
J 0004	1	33726002LCSC	CONNECTOR	
J 0005	1	33726002LCSC	CONNECTOR	
J 0006	1	EMCS1052M	CONNECTOR	10P STRAIGHT
J 0007	1	65611-120	HEADER	20P
J 0008	1	5569-02A1	CONNECTOR	HEADER 2P RA
J 0009	1	5569-02A1	CONNECTOR	HEADER 2P RA
J 0010	1	65507-103	CONNECTOR:PIN	3P SINGLE 2.54PITCH
J 0012	1	EMCS0552M	CONNECTOR PIN	5PIN STRAIGHT

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REF NO	QTY	PARTS NO	DESCRIPTION	
L 0001	1	SN10-400	COIL:CHOCK RECT	3A
MP	2	4G644144-2AB	3X10	SPACER
P 0001	1	EMCM0210D65	CONNECTOR	2P L=100MM
Q 0001	1	2SC828A-RS	TSTR:SI NPN	PC:250MW FT:220MHZ
Q 0002	1	2SA777-RS	TSTR:SI PNP	PC:750MW FT:120MHZ
Q 0003	1	2SA564A-RS	TSTR:SI PNP	PC:250MW FT:80MHZ
R 0001	1	EXBF9E473J	R:NETWORK	47K OHM X8 5% 1/8W
R 0002	1	EXBF9E473J	R:NETWORK	47K OHM X8 5% 1/8W
R 0003	1	EXBF9E473J	R:NETWORK	47K OHM X8 5% 1/8W
R 0004	1	EXBF9E473J	R:NETWORK	47K OHM X8 5% 1/8W
R 0005	1	ERDS2TJ102T	R:FXD CARBON	1K OHM 5% 1/4W
R 0006	1	ERDS2TJ103T	R:FXD CARBON	10K OHM 5% 1/4W
R 0007	1	ERDS2TJ102T	R:FXD CARBON	1K OHM 5% 1/4W
R 0008	1	EXBF9E103J	R:NETWORK	10K OHM X8 5% 1/8W
R 0009	1	ERDS2TJ102T	R:FXD CARBON	1K OHM 5% 1/4W
R 0010	1	ERDS2TJ102T	R:FXD CARBON	1K OHM 5% 1/4W
R 0011	1	EXBF9E103J	R:NETWORK	10K OHM X8 5% 1/8W
R 0012	1	ERDS2TJ102T	R:FXD CARBON	1K OHM 5% 1/4W
R 0013	1	ERDS2TJ471T	R:FXD CARBON	470 OHM 5% 1/4W
R 0014	1	EXBF9E103J	R:NETWORK	10K OHM X8 5% 1/8W
R 0015	1	ERDS2TJ102T	R:FXD CARBON	1K OHM 5% 1/4W
R 0016	1	EXBF9E103J	R:NETWORK	10K OHM X8 5% 1/8W
R 0017	1	ERDS2TJ471T	R:FXD CARBON	470 OHM 5% 1/4W
R 0018	1	ERDS2TJ103T	R:FXD CARBON	10K OHM 5% 1/4W
R 0019	1	ERDS2TJ220T	R:FXD CARBON	22 OHM 5% 1/4W
R 0020	1	ERDS2TJ220T	R:FXD CARBON	22 OHM 5% 1/4W
R 0021	1	EXBF9E103J	R:NETWORK	10K OHM X8 5% 1/8W
R 0022	1	EXBF9E103J	R:NETWORK	10K OHM X8 5% 1/8W
R 0023	1	ERDS2TJ102T	R:FXD CARBON	1K OHM 5% 1/4W
R 0024	1	ERDS2TJ102T	R:FXD CARBON	1K OHM 5% 1/4W
R 0025	1	ERDS2TJ102T	R:FXD CARBON	1K OHM 5% 1/4W
R 0026	1	ERDS2TJ101T	R:FXD CARBON	100 OHM 5% 1/4W
R 0027	1	ERDS2TJ101T	R:FXD CARBON	100 OHM 5% 1/4W
R 0028	1	ERDS2TJ101T	R:FXD CARBON	100 OHM 5% 1/4W
R 0029	1	ERDS2TJ101T	R:FXD CARBON	100 OHM 5% 1/4W
R 0030	1	ERDS2TJ101T	R:FXD CARBON	100 OHM 5% 1/4W
R 0031	1	ERDS2TJ101T	R:FXD CARBON	100 OHM 5% 1/4W
R 0032	1	ERDS2TJ220T	R:FXD CARBON	22 OHM 5% 1/4W
R 0033	1	EXBF9E473J	R:NETWORK	47K OHM X8 5% 1/8W
R 0034	1	ERDS2TJ473T	R:FXD CARBON	47K OHM 5% 1/4W

P8450A DIGITAL DWG NO 4G208618

REF NO	QTY	PARTS NO	DESCRIPTION	
R 0035	1	ERDS2TJ473T	R:FXD CARBON	47K OHM 5% 1/4W
R 0036	1	ERDS2TJ104T	R:FXD CARBON	100K OHM 5% 1/4W
R 0037	1	EXBF9E472J	R:NETWORK	4.7K OHM X8 5% 1/8W : P
R 0038	1	EXBF9E473J	R:NETWORK	47K OHM X8 5% 1/8W
R 0039	1	EXBF9E472J	R:NETWORK	4.7K OHM X8 5% 1/8W : P
R 0040	1	EXBF9E472J	R:NETWORK	4.7K OHM X8 5% 1/8W : P
R 0041	1	EXBF9E473J	R:NETWORK	47K OHM X8 5% 1/8W
R 0042	1	EXBF9E473J	R:NETWORK	47K OHM X8 5% 1/8W
R 0043	1	EXBF9E473J	R:NETWORK	47K OHM X8 5% 1/8W
R 0044	1	ERDS2TJ103T	R:FXD CARBON	10K OHM 5% 1/4W
R 0045	1	ERDS2TJ103T	R:FXD CARBON	10K OHM 5% 1/4W
R 0046	1	EXBF9E103J	R:NETWORK	10K OHM X8 5% 1/8W
R 0047	1	ERDS2TJ102T	R:FXD CARBON	1K OHM 5% 1/4W
R 0048	1	ERDS2TJ104T	R:FXD CARBON	100K OHM 5% 1/4W
R 0049	1	EXBF9E473J	R:NETWORK	47K OHM X8 5% 1/8W
R 0050	1	EXBF9E472J	R:NETWORK	4.7K OHM X8 5% 1/8W : P
R 0051	1	EXBF9E473J	R:NETWORK	47K OHM X8 5% 1/8W
R 0052	1	EXBF9E473J	R:NETWORK	47K OHM X8 5% 1/8W
R 0053	1	EXBF9E473J	R:NETWORK	47K OHM X8 5% 1/8W
R 0054	1	EXBF9E473J	R:NETWORK	47K OHM X8 5% 1/8W
R 0055	1	ERDS2TJ471T	R:FXD CARBON	470 OHM 5% 1/4W
R 0056	1	ERDS2TJ681T	R:FXD CARBON	680 OHM 5% 1/4W
R 0057	1	ERDS2TJ104T	R:FXD CARBON	100K OHM 5% 1/4W
R 0058	1	ERDS2TJ470T	R:FXD CARBON	47 OHM 5% 1/4W
R 0059	1	ERDS2TJ470T	R:FXD CARBON	47 OHM 5% 1/4W
R 0060	1	ERDS2TJ470T	R:FXD CARBON	47 OHM 5% 1/4W
R 0061	1	ERDS2TJ470T	R:FXD CARBON	47 OHM 5% 1/4W
R 0062	1	ERDS2TJ470T	R:FXD CARBON	47 OHM 5% 1/4W
R 0063	1	ERDS2TJ470T	R:FXD CARBON	47 OHM 5% 1/4W
R 0064	1	ERDS2TJ470T	R:FXD CARBON	47 OHM 5% 1/4W
R 0065	1	ERDS2TJ470T	R:FXD CARBON	47 OHM 5% 1/4W
R 0066	1	ERDS2TJ470T	R:FXD CARBON	47 OHM 5% 1/4W
R 0067	1	ERDS2TJ470T	R:FXD CARBON	47 OHM 5% 1/4W
R 0068	1	ERDS2TJ470T	R:FXD CARBON	47 OHM 5% 1/4W
R 0069	1	ERDS2TJ470T	R:FXD CARBON	47 OHM 5% 1/4W
R 0070	1	ERDS2TJ470T	R:FXD CARBON	47 OHM 5% 1/4W
R 0071	1	ERDS2TJ470T	R:FXD CARBON	47 OHM 5% 1/4W
R 0072	1	ERDS2TJ470T	R:FXD CARBON	47 OHM 5% 1/4W
R 0073	1	ERDS2TJ470T	R:FXD CARBON	47 OHM 5% 1/4W
R 0074	1	ERDS2TJ470T	R:FXD CARBON	47 OHM 5% 1/4W
R 0075	1	ERDS2TJ470T	R:FXD CARBON	47 OHM 5% 1/4W
R 0076	1	ERDS2TJ471T	R:FXD CARBON	470 OHM 5% 1/4W

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REF NO	QTY	PARTS NO	DESCRIPTION	
R 0077	1	ERDS2TJ471T	R:FXD CARBON	470 OHM 5% 1/4W
R 0078	1	ERDS2TJ471T	R:FXD CARBON	470 OHM 5% 1/4W
R 0079	1	ERDS2TJ471T	R:FXD CARBON	470 OHM 5% 1/4W
R 0080	1	ERDS2TJ471T	R:FXD CARBON	470 OHM 5% 1/4W
R 0081	1	ERDS2TJ471T	R:FXD CARBON	470 OHM 5% 1/4W
R 0082	1	ERDS2TJ471T	R:FXD CARBON	470 OHM 5% 1/4W
R 0083	1	ERDS2TJ471T	R:FXD CARBON	470 OHM 5% 1/4W
R 0084	1	EXBF9E473J	R:NETWORK	47K OHM X8 5% 1/8W
R 0085	1	EXBF9E473J	R:NETWORK	47K OHM X8 5% 1/8W
R 0086	1	ERDS2TJ102T	R:FXD CARBON	1K OHM 5% 1/4W
R 0087	1	ERDS2TJ103T	R:FXD CARBON	10K OHM 5% 1/4W
R 0088	1	ERDS2TJ102T	R:FXD CARBON	1K OHM 5% 1/4W
R 0089	1	ERDS2TJ471T	R:FXD CARBON	470 OHM 5% 1/4W
U 0001	1	74HC32	IC:HS-CMOS	QUAD 2-OR
U 0002	1	74HC574	IC:HS-CMOS	OCTAL TRI-STATE D-F/F
U 0003	1	27C1024D15	IC:C MOS	64K X16 150NS P-ROM
U 0004	1	27C1024D15	IC:C MOS	64K X16 150NS P-ROM
U 0005	1	27C1024D15	IC:C MOS	64K X16 150NS P-ROM
U 0006	1	UPD43256C12L	IC:C MOS	32KX8 STATIC RAM 120NS
U 0007	1	UPD43256C12L	IC:C MOS	32KX8 STATIC RAM 120NS
U 0008	1	74HC244	IC:HS-CMOS	OCTAL TRI-STATE BUFF
U 0009	1	74HC244	IC:HS-CMOS	OCTAL TRI-STATE BUFF
U 0010	1	74HC244	IC:HS-CMOS	OCTAL TRI-STATE BUFF
U 0011	1	74HC245	IC:HS-CMOS	OCTAL TRI-STATE TRAN
U 0012	1	74HC04	IC:HS-CMOS	HEX INVERTER
U 0013	1	74HC393	IC:HS-CMOS	DUAL 4-BIT BINARY CO
U 0014	1	74HC32	IC:HS-CMOS	QUAD 2-OR
U 0015	1	74HC393	IC:HS-CMOS	DUAL 4-BIT BINARY CO
U 0016	1	74HC157	IC:HS-CMOS	QUAD 2-1 DATA SELECT/MPX
U 0017	1	74HC157	IC:HS-CMOS	QUAD 2-1 DATA SELECT/MPX
U 0018	1	74HC157	IC:HS-CMOS	QUAD 2-1 DATA SELECT/MPX
U 0019	1	74HC157	IC:HS-CMOS	QUAD 2-1 DATA SELECT/MPX
U 0020	1	UPD43256C12L	IC:C MOS	32KX8 STATIC RAM 120NS
U 0021	1	UPD43256C12L	IC:C MOS	32KX8 STATIC RAM 120NS
U 0022	1	74HC138	IC:HS-CMOS	3-TO-8 LINE DECODER
U 0023	1	74HC138	IC:HS-CMOS	3-TO-8 LINE DECODER
U 0024	1	UPD71059C	IC:C MOS	PROG.INTERRUPT CONTROLL.
U 0025	1	UPD71059C	IC:C MOS	PROG.INTERRUPT CONTROLL.
U 0026	1	74HC32	IC:HS-CMOS	QUAD 2-OR
U 0027	1	74HC688	IC:HS-CMOS	8BIT MAGNITUDE COMPA
U 0028	1	74HC20	IC:HS-CMOS	DUAL 4-NAND
U 0029	1	UPD43256C12L	IC:C MOS	32KX8 STATIC RAM 120NS

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REF NO	QTY	PARTS NO	DESCRIPTION	
U 0030	1	UPD43256C12L	IC:C MOS	32KX8 STATIC RAM 120NS
U 0031	1	UPD43256C12L	IC:C MOS	32KX8 STATIC RAM 120NS
U 0032	1	UPD43256C12L	IC:C MOS	32KX8 STATIC RAM 120NS
U 0033	1	74HC138	IC:HS-CMOS	3-TO-8 LINE DECODER
U 0034	1	74HC08	IC:HS-CMOS	QUAD 2-AND
U 0035	1	74HC00	IC:HS-CMOS	QUAD 2-NAND
U 0036	1	PAL16L8ACN	IC:PAL	16IN AND OR INV ARRAY
U 0037	1	74HC688	IC:HS-CMOS	8BIT MAGNITUDE COMPA
U 0038	1	UPD71054C	IC:C MOS	PROG INTERBAL TIMER
U 0039	1	UPD71054C	IC:C MOS	PROG INTERBAL TIMER
U 0040	1	74HC04	IC:HS-CMOS	HEX INVERTER
U 0041	1	74HC574	IC:HS-CMOS	OCTAL TRI-STATE D-F/F
U 0042	1	74HC541	IC:HS-CMOS	OCTAL TRI-STATE BUFF
U 0043	1	74HC157	IC:HS-CMOS	QUAD 2-1 DATA SELECT/MPX
U 0044	1	74HC74	IC:HS-CMOS	DUAL D-TYPE F/F
U 0045	1	74HC166	IC:HS-CMOS	8BIT SHIFT REGISTER PISO
U 0046	1	74HC166	IC:HS-CMOS	8BIT SHIFT REGISTER PISO
U 0047	1	74HC161	IC:HS-CMOS	SYNC.4-BIT COUNTER
U 0048	1	74HC74	IC:HS-CMOS	DUAL D-TYPE F/F
U 0049	1	74HC04	IC:HS-CMOS	HEX INVERTER
U 0050	1	MC68000P12	IC: HMOS	16BIT MPU
U 0052	1	74HC02	IC:HS-CMOS	QUAD 2-NOR
U 0053	1	74HC541	IC:HS-CMOS	OCTAL TRI-STATE BUFF
U 0054	1	74HC574	IC:HS-CMOS	OCTAL TRI-STATE D-F/F
U 0055	1	PAL16L8ACN	IC:PAL	16IN AND OR INV ARRAY
U 0056	1	74HC164	IC:HS-CMOS	8BIT SHIFT REGISTER
U 0057	1	74HC08	IC:HS-CMOS	QUAD 2-AND
U 0058	1	74HC74	IC:HS-CMOS	DUAL D-TYPE F/F
U 0059	1	SN74LS06N	IC:TTL LS	HEX INVERTER BUFFER
U 0060	1	PAL16L8ACN	IC:PAL	16IN AND OR INV ARRAY
U 0061	1	74HC30	IC:HS-CMOS	8-NAND
U 0062	1	74HC164	IC:HS-CMOS	8BIT SHIFT REGISTER
U 0063	1	74HC164	IC:HS-CMOS	8BIT SHIFT REGISTER
U 0064	1	74HC245	IC:HS-CMOS	OCTAL TRI-STATE TRAN
U 0065	1	74HC245	IC:HS-CMOS	OCTAL TRI-STATE TRAN
U 0066	1	CXK5814P-35L	IC:MOS	2K X8 STATIC RAM
U 0067	1	CXK5814P-35L	IC:MOS	2K X8 STATIC RAM
U 0068	1	74F374PC	IC:FAST	D-TYPE FLIP FLOPS
U 0069	1	74F374PC	IC:FAST	D-TYPE FLIP FLOPS
U 0070	1	74F283PC	IC:FAST	4BIT BINARY ADDER
U 0071	1	74F283PC	IC:FAST	4BIT BINARY ADDER
U 0072	1	PAL16L8ACN	IC:PAL	16IN AND OR INV ARRAY

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REF NO	QTY	PARTS NO	DESCRIPTION	
U 0073	1	74HC04	IC:HS-CMOS	HEX INVERTER
U 0074	1	SN74LS06N	IC:TTL LS	HEX INVERTER BUFFER
U 0075	1	SN74LS393N	IC:TTL LS	DUAL BINARY COUNTER
U 0076	1	SN74LS04N	IC:TTL LS	HEX INVERTER
U 0077	1	74F04PC	IC:FAST	HEX INVERTER
U 0078	1	74F74PC	IC:FAST	DUAL D-TYPE FLIP-FLOP
U 0079	1	74F157PC	IC:FAST	QUAD 2-INPUT MPX
U 0080	1	74F157PC	IC:FAST	QUAD 2-INPUT MPX
U 0081	1	74F157PC	IC:FAST	QUAD 2-INPUT MPX
U 0082	1	74F283PC	IC:FAST	4BIT BINARY ADDER
U 0083	1	74HC373	IC:HS-CMOS	OCTAL TRI-STATE D-LA
U 0084	1	74HC373	IC:HS-CMOS	OCTAL TRI-STATE D-LA
U 0085	1	74HC373	IC:HS-CMOS	OCTAL TRI-STATE D-LA
U 0086	1	74HC373	IC:HS-CMOS	OCTAL TRI-STATE D-LA
U 0087	1	UPD71055C	IC:C MOS	PROG.RERIPHERAL IF
U 0088	1	UPD71055C	IC:C MOS	PROG.RERIPHERAL IF
U 0089	1	UPD71055C	IC:C MOS	PROG.RERIPHERAL IF
U 0090	1	UPD7210C	IC:N MOS	GP-IB CONTROLLER
U 0091	1	UPD71055C	IC:C MOS	PROG.RERIPHERAL IF
U 0092	1	74F191PC	IC:FAST	SYNC.U/D 4BIT COUNT
U 0093	1	74F191PC	IC:FAST	SYNC.U/D 4BIT COUNT
U 0094	1	74HC574	IC:HS-CMOS	OCTAL TRI-STATE D-F/F
U 0095	1	SN74LS688N	IC:TTL LS	8-BIT COMPARATOR
U 0096	1	74F157PC	IC:FAST	QUAD 2-INPUT MPX
U 0097	1	74F283PC	IC:FAST	4BIT BINARY ADDER
U 0098	1	74HC373	IC:HS-CMOS	OCTAL TRI-STATE D-LA
U 0099	1	74HC373	IC:HS-CMOS	OCTAL TRI-STATE D-LA
U 0100	1	74HC373	IC:HS-CMOS	OCTAL TRI-STATE D-LA
U 0101	1	74HC373	IC:HS-CMOS	OCTAL TRI-STATE D-LA
U 0102	1	74F163PC	IC:FAST	COUNTER
U 0103	1	74F163PC	IC:FAST	COUNTER
U 0104	1	74F20PC	IC:FAST	DUAL 4-INPUT NAND GATE
U 0105	1	74F00PC	IC:FAST	QUAD 2-INPUT NAND GATE
U 0106	1	74HC125	IC:HS-CMOS	QUAD BUS BUFFER(3-STATE)
U 0107	1	74F138PC	IC:FAST	3-T0-8 LINE DECODER
U 0108	1	74HC174	IC:HS-CMOS	HEX D-TYPE F/F (CK,CLR)
U 0109	1	74HC174	IC:HS-CMOS	HEX D-TYPE F/F (CK,CLR)
U 0110	1	74HC174	IC:HS-CMOS	HEX D-TYPE F/F (CK,CLR)
U 0111	1	74HC174	IC:HS-CMOS	HEX D-TYPE F/F (CK,CLR)
U 0112	1	74HC00	IC:HS-CMOS	QUAD 2-NAND
U 0113	1	MB3771	IC	
U 0114	1	SN74LS541N	IC:TTL LS	OCTAL BUFFER 3-STATE

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REF NO	QTY	PARTS NO	DESCRIPTION	
U 0115	1	SN74LS148N	IC:TTL LS	8-TO-3 LINE ENCODER
U 0116	1	74HC541	IC:HS-CMOS	OCTAL TRI-STATE BUFF
U 0117	1	SN75160AN	IC:TTL	OCTAL IF-BUS TRANSCE
U 0118	1	SN75161AN	IC:TTL	OCTAL IF-BUS TRANSCE
U 0119	1	74F74PC	IC:FAST	DUAL D-TYPE FLIP-FLOP
U 0120	1	74F163PC	IC:FAST	COUNTER
U 0121	1	74F02PC	IC:FAST	NOR GATE
U 0122	1	74HC04	IC:HS-CMOS	HEX INVERTER
U 0123	1	74HC155	IC:HS-CMOS	DUAL 2-4 DECOD./DE-M
U 0124	1	74HC74	IC:HS-CMOS	DUAL D-TYPE F/F
U 0125	1	74HC174	IC:HS-CMOS	HEX D-TYPE F/F (CK,CLR)
U 0126	1	74HC174	IC:HS-CMOS	HEX D-TYPE F/F (CK,CLR)
U 0127	1	74HC174	IC:HS-CMOS	HEX D-TYPE F/F (CK,CLR)
U 0128	1	74HC174	IC:HS-CMOS	HEX D-TYPE F/F (CK,CLR)
XU 0003	1	DILB40P-8J	IC SOCKET	40-PIN DIL
XU 0004	1	DILB40P-8J	IC SOCKET	40-PIN DIL
XU 0005	1	DILB40P-8J	IC SOCKET	40-PIN DIL
XU 0036	1	DILB20P-8J	IC SOCKET	20-PIN DIL
XU 0055	1	DILB20P-8J	IC SOCKET	20-PIN DIL
XU 0060	1	DILB20P-8J	IC SOCKET	20-PIN DIL
XU 0072	1	DILB20P-8J	IC SOCKET	20-PIN DIL
Y 0001	1	EXO3C24.000M	CRYSTAL:QUARTZ	EXO3C 24.000MHZ

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REF NO	QTY	PARTS NO	DESCRIPTION	
C 0001	1	ECCF1H270JC	C:FXD CER TC	27PF +-5% 50V NPO
C 0002	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0003	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0004	1	ECCF1H270JC	C:FXD CER TC	27PF +-5% 50V NPO
C 0005	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0006	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0007	1	ECCF1H270JC	C:FXD CER TC	27PF +-5% 50V NPO
C 0008	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0009	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0010	1	ECCF1H270JC	C:FXD CER TC	27PF +-5% 50V NPO
C 0011	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0012	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0013	1	ECCF1H270JC	C:FXD CER TC	27PF +-5% 50V NPO
C 0014	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0015	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0016	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0017	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0018	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0019	1	ECBT1E103ZF5	C:FXD CER	0.01UPF +80-20% 25V
C 0020	1	ECBT1H220JC5	C:FXD CER TC	22PF 50V +-5%
C 0021	1	ECBT1H220JC5	C:FXD CER TC	22PF 50V +-5%
C 0022	1	ECCF1H270JC	C:FXD CER TC	27PF +-5% 50V NPO
C 0023	1	ECBT1H3R3KC5	C:FXD CERAMIC	3.3PF +-10% 50V
C 0024	1	ECBT1E103ZF5	C:FXD CER	0.01UPF +80-20% 25V
C 0025	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0026	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0027	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0028	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0029	1	ECQP1471FZ	C:FXD FLM	470PF 1% 100V
C 0030	1	ECQP1101JZ	C:FXD FLM	100PF 5% 100V
C 0031	1	DM15E300G1	C:FXD MICA	30PF 2% 100V
C 0032	1	DM15E750F1	C:FXD MICA	75PF 1% 100V
C 0033	1	DM15E680F1	C:FXD MICA	68PF 1% 100V
C 0034	1	DM15E111F1	C:FXD MICA	110PF 1% 100V
C 0035	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0036	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0038	1	DM15E101F1	C:FXD MICA	100PF 1% 100V
C 0039	1	DM15E161F1	C:FXD MICA	160PF 1% 100V
C 0040	1	DM15E511F1	C:FXD MICA	510PF 1% 100V
C 0041	1	DM15E201F1	C:FXD MICA	200PF 1% 100V
C 0042	1	DM15E471F1	C:FXD MICA	470PF 1% 100V
C 0043	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V

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REF NO	QTY	PARTS NO	DESCRIPTION	
C 0044	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0045	1	ECBT1H101KB5	C:FXD CER TC	100PF +-10% 50V
C 0046	1	ECBT1H181KB5	C:FXD CER TC	180PF +-10% 50V
C 0047	1	ECQP1201JZ	C:FXD FLM	200PF 5% 100V
C 0048	1	ECQP1621JZ	C:FXD FLM	620PF 5% 100V
C 0049	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0050	1	ECQP1101JZ	C:FXD FLM	100PF 5% 100V
C 0051	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0052	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0053	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0054	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0055	1	ECQP1201JZ	C:FXD FLM	200PF 5% 100V
C 0056	1	ECQP1621JZ	C:FXD FLM	620PF 5% 100V
C 0057	1	ECQP1101JZ	C:FXD FLM	100PF 5% 100V
C 0058	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0059	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0060	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0061	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0062	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0063	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0064	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0065	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0066	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0067	1	ECQP1102FZ3	C:FXD FLM	1000PF +-1% 100V
C 0068	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0069	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0070	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0071	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0072	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0073	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0074	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0075	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0076	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0077	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0078	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0079	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0080	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0081	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0082	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0083	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0084	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0085	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V

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REF NO	QTY	PARTS NO	DESCRIPTION	
C 0086	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0087	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0088	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0089	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0090	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0091	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0093	1	ECEA1CU221B	C:FXD AL ELECT	220UF +-20% 16V
C 0096	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0097	1	ECQE1103KN	C:FXD FLM	0.01UF 10% 100V
C 0101	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0102	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0103	1	ECBT1E103ZF5	C:FXD CER	0.01UPF +80-20% 25V
C 0104	1	ECBT1E103ZF5	C:FXD CER	0.01UPF +80-20% 25V
C 0105	1	ECQE1103KN	C:FXD FLM	0.01UF 10% 100V
C 0106	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0107	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0108	1	ECQE1224GN	C:FXD FLM	0.22UF 2% 100V
C 0109	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0110	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0111	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0112	1	ECQP1121JZ	C:FXD FLM	120PF 5% 100V
C 0113	1	ECBT1H2R2KC5	C:FXD CER TC	2.2PF 50V +-10%
C 0114	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0115	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0116	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0117	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0118	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0119	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0120	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0121	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0122	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0123	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0124	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0125	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0126	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0127	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0128	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0129	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0130	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0131	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0132	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0133	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V

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REF NO	QTY	PARTS NO	DESCRIPTION	
C 0134	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0135	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0136	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0137	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0138	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0139	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0140	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0141	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0142	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0143	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0144	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0145	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0146	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0147	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0148	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0149	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0150	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0151	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0152	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0153	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0154	1	ECCF1H470JC	C:FXD CER TC	47PF +-5% 50V NPO
C 0155	1	ECBT1H220JC5	C:FXD CER TC	22PF 50V +-5%
C 0156	1	ECBT1H101KB5	C:FXD CER TC	100PF +-10% 50V
C 0157	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0158	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0159	1	ECBT1H100JC5	C:FXD CER TC	10PF +-5% 50V NPO
C 0160	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0161	1	ECBT1H8R2KC5	C:FXD CER	8.2PF +-10% 50V NPO
C 0162	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0163	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0164	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0165	1	ECQP1181JZ	C:FXD FLM	180PF 5% 100V
C 0166	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0167	1	ECBT1H102KB5	C:FXD CER HI-K	1000PF 50V +-10%
C 0168	1	ECQP1102FZ3	C:FXD FLM	1000PF +-1% 100V
C 0169	1	ECQP1102FZ3	C:FXD FLM	1000PF +-1% 100V
C 0170	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0171	1	ECQE1104KN	C:FXD FLM	0.1UF 10% 100V
C 0172	1	ECQP1561JZ	C:FXD FLM	560PF +-5% 100V
C 0173	1	ECKF1H472MD	C:FXD CER HI-K	4700PF +-20% 50V
C 0174	1	ECQE1224GN	C:FXD FLM	0.22UF 2% 100V
C 0175	1	ECBT1E103ZF5	C:FXD CER	0.01UPF +80-20% 25V

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REF NO	QTY	PARTS NO	DESCRIPTION
C 0176	1	ECBT1E103ZF5	C:FXD CER 0.01UPF +80-20% 25V
C 0177	1	SA055F104ZB2	C:FXD CER AXIAL 0.1UF +80% -20% 50V
C 0178	1	ECBT1E103ZF5	C:FXD CER 0.01UPF +80-20% 25V
C 0179	1	ECBT1E103ZF5	C:FXD CER 0.01UPF +80-20% 25V
C 0180	1	SA055F104ZB2	C:FXD CER AXIAL 0.1UF +80% -20% 50V
C 0181	1	SA055F104ZB2	C:FXD CER AXIAL 0.1UF +80% -20% 50V
C 0182	1	ECBT1E103ZF5	C:FXD CER 0.01UPF +80-20% 25V
C 0183	1	SA055F104ZB2	C:FXD CER AXIAL 0.1UF +80% -20% 50V
C 0184	1	SA055F104ZB2	C:FXD CER AXIAL 0.1UF +80% -20% 50V
C 0185	1	SA055F104ZB2	C:FXD CER AXIAL 0.1UF +80% -20% 50V
C 0186	1	SA055F104ZB2	C:FXD CER AXIAL 0.1UF +80% -20% 50V
C 0187	1	SA055F104ZB2	C:FXD CER AXIAL 0.1UF +80% -20% 50V
C 0188	1	SA055F104ZB2	C:FXD CER AXIAL 0.1UF +80% -20% 50V
C 0189	1	ECBT1C222MR5	C:FXD CER TC 2200PF +-20% 50V
C 0190	1	SA055F104ZB2	C:FXD CER AXIAL 0.1UF +80% -20% 50V
C 0191	1	ECQE1224GN	C:FXD FLM 0.22UF 2% 100V
C 0192	1	ECQE1104KN	C:FXD FLM 0.1UF 10% 100V
C 0193	1	SA055F104ZB2	C:FXD CER AXIAL 0.1UF +80% -20% 50V
C 0194	1	ECBT1H102KB5	C:FXD CER HI-K 1000PF 50V +-10%
C 0195	1	ECBT1H102KB5	C:FXD CER HI-K 1000PF 50V +-10%
C 0196	1	ECCF1H100FC	C:FXD CER TC 10PF +-1.0PF 50V NPO
C 0197	1	ECCF1H150KC	C:FXD CER TC 15PF +-10% 50V NPO
C 0198	1	ECEA1CN470S	C:FXD AL ELECT 47UF +-20% 16V
C 0199	1	ECEA1CU470B	C:FXD AL ELECT 47UF +-20% 16V
C 0200	1	ECEA1CU470B	C:FXD AL ELECT 47UF +-20% 16V
C 0201	1	ECEA1CN470S	C:FXD AL ELECT 47UF +-20% 16V
C 0202	1	ECEA1CU470B	C:FXD AL ELECT 47UF +-20% 16V
C 0203	1	ECEA1CU470B	C:FXD AL ELECT 47UF +-20% 16V
C 0204	1	ECEA1CN470S	C:FXD AL ELECT 47UF +-20% 16V
C 0205	1	ECEA1CU470B	C:FXD AL ELECT 47UF +-20% 16V
C 0206	1	ECEA1CU470B	C:FXD AL ELECT 47UF +-20% 16V
C 0207	1	ECEA1CN470S	C:FXD AL ELECT 47UF +-20% 16V
C 0208	1	ECEA1CU470B	C:FXD AL ELECT 47UF +-20% 16V
C 0209	1	ECEA1CU470B	C:FXD AL ELECT 47UF +-20% 16V
C 0210	1	ECEA1CN470S	C:FXD AL ELECT 47UF +-20% 16V
C 0211	1	ECEA1CU470B	C:FXD AL ELECT 47UF +-20% 16V
C 0212	1	ECEA1CU470B	C:FXD AL ELECT 47UF +-20% 16V
C 0213	1	ECEA1CN470S	C:FXD AL ELECT 47UF +-20% 16V
C 0214	1	ECEA1CN470S	C:FXD AL ELECT 47UF +-20% 16V
C 0215	1	ECEA1CU470B	C:FXD AL ELECT 47UF +-20% 16V
C 0216	1	ECEA1CU470B	C:FXD AL ELECT 47UF +-20% 16V
C 0217	1	ECEA1CU470B	C:FXD AL ELECT 47UF +-20% 16V

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REF NO	QTY	PARTS NO	DESCRIPTION	
C 0218	1	ECEA1CN221S	C:FXD AL ELECT	220UF +-20% 16V
C 0219	1	ECEA1CU470B	C:FXD AL ELECT	47UF +-20% 16V
C 0220	1	ECEA1CU470B	C:FXD AL ELECT	47UF +-20% 16V
C 0221	1	ECEA1CU470B	C:FXD AL ELECT	47UF +-20% 16V
C 0222	1	ECEA1CU470B	C:FXD AL ELECT	47UF +-20% 16V
C 0223	1	ECEA1CU470B	C:FXD AL ELECT	47UF +-20% 16V
C 0224	1	ECEA1CU470B	C:FXD AL ELECT	47UF +-20% 16V
C 0225	1	ECEA1CU470B	C:FXD AL ELECT	47UF +-20% 16V
C 0226	1	ECEA1CU470B	C:FXD AL ELECT	47UF +-20% 16V
C 0227	1	ECEA1CU470B	C:FXD AL ELECT	47UF +-20% 16V
C 0228	1	ECEA1CU470B	C:FXD AL ELECT	47UF +-20% 16V
C 0230	1	ECEA1CU470B	C:FXD AL ELECT	47UF +-20% 16V
C 0234	1	ECEA1CU470B	C:FXD AL ELECT	47UF +-20% 16V
C 0235	1	ECEA1CU470B	C:FXD AL ELECT	47UF +-20% 16V
C 0236	1	ECEA1CU470B	C:FXD AL ELECT	47UF +-20% 16V
C 0237	1	ECEA1CU470B	C:FXD AL ELECT	47UF +-20% 16V
C 0238	1	ECEA1AU101B	C:FXD AL ELECT	100UF +-20% 10V
C 0239	1	ECEA1CU101B	C:FXD AL ELECT	100UF +-20% 16V
C 0240	1	ECEA1AU101B	C:FXD AL ELECT	100UF +-20% 10V
C 0241	1	ECEA1CU101B	C:FXD AL ELECT	100UF +-20% 16V
C 0242	1	ECEA1CU101B	C:FXD AL ELECT	100UF +-20% 16V
C 0243	1	ECEA1CU101B	C:FXD AL ELECT	100UF +-20% 16V
C 0244	1	ECEA1CU101B	C:FXD AL ELECT	100UF +-20% 16V
C 0245	1	ECEA1CU101B	C:FXD AL ELECT	100UF +-20% 16V
C 0246	1	ECEA1CU101B	C:FXD AL ELECT	100UF +-20% 16V
C 0247	1	ECEA1AU101B	C:FXD AL ELECT	100UF +-20% 10V
C 0248	1	ECEA1AU101B	C:FXD AL ELECT	100UF +-20% 10V
C 0249	1	ECEA1AU101B	C:FXD AL ELECT	100UF +-20% 10V
C 0250	1	ECEA1AU101B	C:FXD AL ELECT	100UF +-20% 10V
C 0251	1	ECEA1CU470B	C:FXD AL ELECT	47UF +-20% 16V
C 0252	1	ECEA1CU470B	C:FXD AL ELECT	47UF +-20% 16V
C 0253	1	ECEA1CU470B	C:FXD AL ELECT	47UF +-20% 16V
C 0254	1	ECEA1HN2R2S	C:FXD AL ELECT	2.2UF 50V NPO
C 0255	1	ECCF1H270JC	C:FXD CER TC	27PF +-5% 50V NPO
C 0256	1	ECEA1CU470B	C:FXD AL ELECT	47UF +-20% 16V
C 0257	1	ECEA1CU470B	C:FXD AL ELECT	47UF +-20% 16V
C 0258	1	ECV1ZW06X53T	C:VAR CER	8PF-2PF 250V
C 0259	1	ECV1ZW06X53T	C:VAR CER	8PF-2PF 250V
C 0260	1	ECV1ZW06X53T	C:VAR CER	8PF-2PF 250V
C 0261	1	ECV1ZW06X53T	C:VAR CER	8PF-2PF 250V
C 0262	1	ECV1ZW06X53T	C:VAR CER	8PF-2PF 250V
C 0263	1	ECV1ZW50X32	C:VAR CER	55PF-5PF 250V

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REF NO	QTY	PARTS NO	DESCRIPTION	
C 0264	1	ECV1ZW10X32	C:VAR CER	12PF-2PF 250V
C 0265	1	ECV1ZW10X32	C:VAR CER	12PF-2PF 250V
C 0266	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0267	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0268	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0269	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0270	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0271	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0272	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0273	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0274	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0275	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0276	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0277	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0278	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0279	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0280	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0281	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0282	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0283	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0284	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0285	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0286	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0287	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0288	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0289	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0290	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0291	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0292	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0293	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0294	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0295	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0296	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0297	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0298	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0299	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0300	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0301	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0302	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0303	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0304	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0305	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V

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REF NO	QTY	PARTS NO	DESCRIPTION	
C 0306	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0307	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0308	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0309	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0310	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0311	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0312	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0313	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0314	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0315	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0316	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0317	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0318	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0319	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0320	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0321	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0322	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0323	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0324	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0325	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0326	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0327	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0328	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0329	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0330	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0331	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0332	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0333	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0334	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0335	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0336	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0337	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0338	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0339	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0340	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0341	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0342	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0343	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0344	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0345	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0346	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0347	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V

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REF NO	QTY	PARTS NO	DESCRIPTION	
C 0348	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0349	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0350	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0351	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0352	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0353	1	SA055F104ZB2	C:FXD CER AXIAL	0.1UF +80% -20% 50V
C 0355	1	ECCF1H030CC	C:FXD CER TC	3PF +-0.25PF 50V NPO
CR 0001	1	IN5711	DIODE:SI	15MA 1.0V 2.0PF
CR 0002	1	MA165TA	DIODE	75V 100MA
CR 0003	1	MA165TA	DIODE	75V 100MA
CR 0003	1	RD6.2EB2	DIODE:ZENER	6.0V 500MW
CR 0006	1	RD6.2EB2	DIODE:ZENER	6.0V 500MW
CR 0011	1	MA165TA	DIODE	75V 100MA
CR 0012	1	MA165TA	DIODE	75V 100MA
CR 0013	1	1SS99	DIODE:SI	30MA 5V UHF MIXER
CR 0014	1	1SS99	DIODE:SI	30MA 5V UHF MIXER
CR 0015	1	1SS99	DIODE:SI	30MA 5V UHF MIXER
CR 0016	1	MA165TA	DIODE	75V 100MA
CR 0017	1	MA165TA	DIODE	75V 100MA
CR 0018	1	MA165TA	DIODE	75V 100MA
CR 0019	1	MA165TA	DIODE	75V 100MA
CR 0020	1	MA165TA	DIODE	75V 100MA
CR 0021	1	MA165TA	DIODE	75V 100MA
CR 0022	1	MA165TA	DIODE	75V 100MA
CR 0023	1	1SV101	DIODE:VAR CAP	
CR 0024	1	1SV101	DIODE:VAR CAP	
CR 0025	1	MA165TA	DIODE	75V 100MA
CR 0026	1	MA165TA	DIODE	75V 100MA
CR 0027	1	MA165TA	DIODE	75V 100MA
CR 0028	1	MA165TA	DIODE	75V 100MA
CR 0029	1	MA165TA	DIODE	75V 100MA
CR 0030	1	MA165TA	DIODE	75V 100MA
DL 0001	1	65Z14B100	DELAY LINE	DIL 100NS OUTPUT
DL 0002	1	65Z14B050	DELAY LINE	DIL 50NS OUTPUT
E	24	LC-3-S-Y	TEST POINT	
E	1	2G401827-1	PCB,ANALOG	P8450A
J 0001	1	5273-02A	CONNECTOR:COAX	2P ST
J 0002	1	5273-03A	CONNECTOR:COAX	3P ST
J 0003	1	5273-02A	CONNECTOR:COAX	2P ST
J 0004	1	65507-103	CONNECTOR:PIN	3P SINGLE 2.54PITCH
J 0005	1	33726002LCSC	CONNECTOR	

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REF NO	QTY	PARTS NO	DESCRIPTION	
J 0006	1	33725002LCSC	CONNECTOR:HEADER	60P RIGHT ANGLE
J 0007	1	EMCS0252M	CONNECTOR PIN	2P STRAIGHT
J 0008	1	SML010	CONNECTOR:COAX	SML RECEPT
J 0009	1	SML010	CONNECTOR:COAX	SML RECEPT
J 0010	1	SML010	CONNECTOR:COAX	SML RECEPT
J 0011	1	SML010	CONNECTOR:COAX	SML RECEPT
J 0012	1	SML010	CONNECTOR:COAX	SML RECEPT
J 0013	1	SML010	CONNECTOR:COAX	SML RECEPT
J 0014	1	SML010	CONNECTOR:COAX	SML RECEPT
J 0015	1	SML010	CONNECTOR:COAX	SML RECEPT
J 0016	1	SML010	CONNECTOR:COAX	SML RECEPT
J 0017	1	SML010	CONNECTOR:COAX	SML RECEPT
J 0018	1	SML010	CONNECTOR:COAX	SML RECEPT
K 0001	1	S105NME	REED RELAY	50OHM 1M 1000MHZ
K 0002	1	S105NME	REED RELAY	50OHM 1M 1000MHZ
K 0003	1	S105NME	REED RELAY	50OHM 1M 1000MHZ
K 0004	1	S105NME	REED RELAY	50OHM 1M 1000MHZ
K 0005	1	S105NME	REED RELAY	50OHM 1M 1000MHZ
K 0006	1	S105NME	REED RELAY	50OHM 1M 1000MHZ
K 0007	1	S105NME	REED RELAY	50OHM 1M 1000MHZ
K 0008	1	S105NME	REED RELAY	50OHM 1M 1000MHZ
K 0009	1	S105NME	REED RELAY	50OHM 1M 1000MHZ
K 0010	1	S105NME	REED RELAY	50OHM 1M 1000MHZ
K 0011	1	AE5649	REED RELAY	5V 1A-20VDC 1PDT NR
K 0012	1	AE5649	REED RELAY	5V 1A-20VDC 1PDT NR
K 0013	1	AE5649	REED RELAY	5V 1A-20VDC 1PDT NR
K 0014	1	AE5649	REED RELAY	5V 1A-20VDC 1PDT NR
K 0015	1	AE5649	REED RELAY	5V 1A-20VDC 1PDT NR
L 0001	1	ELEH6R8KA	COIL: FXD	6.8UH +-10%
L 0002	1	ELEH3R9KA	COIL:CHOKE	3.9UH 10%
L 0003	1	ELEH101KA	COIL:CHOKE	100UH 10%
L 0004	1	4G431409	LPF-1	P8400A 2.58 UH
L 0005	1	4G431410	LPF-2	P8400A 2.26 UH
L 0006	1	4G431411	LPF-3	P8400A 2.05UH
L 0011	1	3L0004	FERRITE CORE	
L 0012	1	3L0004	FERRITE CORE	
L 0013	1	3L0004	FERRITE CORE	
L 0014	1	3L0004	FERRITE CORE	
L 0015	1	ELEH821KA	COIL:CHOKE	820UH 10%
L 0016	1	SN8S500	COIL:CHOKE	2A
L 0017	1	SN8S500	COIL:CHOKE	2A
L 0018	1	SN8S500	COIL:CHOKE	2A

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REF NO	QTY	PARTS NO	DESCRIPTION	
L 0019	1	SN8S500	COIL:CHOKE	2A
Q 0021	1	2SC1215TA	TSTR:SI NPN	PC:200MW FT:1200MHZ
Q 0022	1	2SC828ATA-RS	TSTR:SI NPN	PC:250MW FT:220MHZ
Q 0023	1	2SC1215TA	TSTR:SI NPN	PC:200MW FT:1200MHZ
Q 0024	1	2SA1206-T	TSTR: SI PNP	PC:600MW FT:1000MHZ
Q 0025	1	2SA1206-T	TSTR: SI PNP	PC:600MW FT:1000MHZ
Q 0026	1	2SC2851	TSTR:SI	
Q 0027	1	2SC2026-T	TSTR:SI NPN	PC:250MW FT:2000MHZ
Q 0028	1	2SA1206-T	TSTR: SI PNP	PC:600MW FT:1000MHZ
Q 0029	1	2SC2901-T	TSTR:SI NPN	PC:600MW FT:750MHZ
Q 0030	1	2SC2026-T	TSTR:SI NPN	PC:250MW FT:2000MHZ
Q 0031	1	2SC2901-T	TSTR:SI NPN	PC:600MW FT:750MHZ
Q 0032	1	UPA71AM	TSTR:FET	PC:250MW
Q 0034	1	2SC2026-T	TSTR:SI NPN	PC:250MW FT:2000MHZ
Q 0035	1	2SA1206-T	TSTR: SI PNP	PC:600MW FT:1000MHZ
Q 0036	1	2SA1206-T	TSTR: SI PNP	PC:600MW FT:1000MHZ
Q 0037	1	2SA1206-T	TSTR: SI PNP	PC:600MW FT:1000MHZ
Q 0038	1	2SC2026-T	TSTR:SI NPN	PC:250MW FT:2000MHZ
Q 0039	1	2SA1206-T	TSTR: SI PNP	PC:600MW FT:1000MHZ
Q 0040	1	2SA1206-T	TSTR: SI PNP	PC:600MW FT:1000MHZ
Q 0041	1	UPA71AM	TSTR:FET	PC:250MW
Q 0043	1	2SA1206-T	TSTR: SI PNP	PC:600MW FT:1000MHZ
Q 0044	1	2SA684	TSTR:SI PNP	PC:1W FT:200MHZ
Q 0050	1	2SA1206-T	TSTR: SI PNP	PC:600MW FT:1000MHZ
Q 0051	1	2SC2634	TSTR:SI NPN	PC:400MW
Q 0052	1	2SA1127-T	TSTR:SI PNP	PC:400MW NV:150MV
Q 0053	1	2SC828ATA-RS	TSTR:SI NPN	PC:250MW FT:220MHZ
Q 0054	1	2SA1206-T	TSTR: SI PNP	PC:600MW FT:1000MHZ
Q 0055	1	2SC1215TA	TSTR:SI NPN	PC:200MW FT:1200MHZ
Q 0056	1	2SA1206-T	TSTR: SI PNP	PC:600MW FT:1000MHZ
Q 0057	1	2SA1206-T	TSTR: SI PNP	PC:600MW FT:1000MHZ
Q 0058	1	2SK168-E	TSTR:FET	PC:200MW IDSS:6-2MA
Q 0059	1	2SC828ATA-RS	TSTR:SI NPN	PC:250MW FT:220MHZ
Q 0060	1	2SA1206-T	TSTR: SI PNP	PC:600MW FT:1000MHZ
Q 0061	1	2SC1215TA	TSTR:SI NPN	PC:200MW FT:1200MHZ
Q 0062	1	2SA1206-T	TSTR: SI PNP	PC:600MW FT:1000MHZ
Q 0063	1	2SC1215TA	TSTR:SI NPN	PC:200MW FT:1200MHZ
Q 0064	1	2SC1215TA	TSTR:SI NPN	PC:200MW FT:1200MHZ
Q 0065	1	3SK22-GR	TSTR:FET	PC:200MW
Q 0066	1	2SC1215TA	TSTR:SI NPN	PC:200MW FT:1200MHZ

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REF NO	QTY	PARTS NO	DESCRIPTION
R 0001	1	EROS2TKF75R0	R:FXD MET FLM 75.0 OHM 1% 1/4W
R 0002	1	EROS2TKF4991	R:FXD MET FLM 4.99K OHM 1% 1/4W
R 0003	1	EROS2TKF2052	R:FXD MET FLM 20.5K OHM 1% 1/4W
R 0004	1	EXBF9E472J	R:NETWORK 4.7K OHM X8 5% 1/8W : P
R 0005	1	EROS2TKF1000	R:FXD MET FLM 100 OHM 1% 1/4W
R 0006	1	ERDS2TJ472T	R:FXD CARBON 4.7K OHM 5% 1/4W
R 0007	1	EROS2TKF75R0	R:FXD MET FLM 75.0 OHM 1% 1/4W
R 0008	1	EROS2TKF4991	R:FXD MET FLM 4.99K OHM 1% 1/4W
R 0009	1	EROS2TKF1912	R:FXD MET FLM 19.1K OHM 1% 1/4W
R 0011	1	EROS2TKF1000	R:FXD MET FLM 100 OHM 1% 1/4W
R 0013	1	EROS2TKF75R0	R:FXD MET FLM 75.0 OHM 1% 1/4W
R 0014	1	EROS2TKF4991	R:FXD MET FLM 4.99K OHM 1% 1/4W
R 0015	1	EROS2TKF1912	R:FXD MET FLM 19.1K OHM 1% 1/4W
R 0016	1	EROS2TKF1002	R:FXD MET FLM 10.0K OHM 1% 1/4W
R 0017	1	EROS2TKF1000	R:FXD MET FLM 100 OHM 1% 1/4W
R 0018	1	EROS2TKF1002	R:FXD MET FLM 10.0K OHM 1% 1/4W
R 0019	1	EROS2TKF75R0	R:FXD MET FLM 75.0 OHM 1% 1/4W
R 0020	1	EROS2TKF4991	R:FXD MET FLM 4.99K OHM 1% 1/4W
R 0021	1	EROS2TKF1912	R:FXD MET FLM 19.1K OHM 1% 1/4W
R 0022	1	EROS2TKF1002	R:FXD MET FLM 10.0K OHM 1% 1/4W
R 0023	1	EROS2TKF1000	R:FXD MET FLM 100 OHM 1% 1/4W
R 0024	1	EROS2TKF1002	R:FXD MET FLM 10.0K OHM 1% 1/4W
R 0025	1	EROS2TKF75R0	R:FXD MET FLM 75.0 OHM 1% 1/4W
R 0026	1	EROS2TKF4991	R:FXD MET FLM 4.99K OHM 1% 1/4W
R 0027	1	EROS2TKF1912	R:FXD MET FLM 19.1K OHM 1% 1/4W
R 0028	1	EROS2TKF1002	R:FXD MET FLM 10.0K OHM 1% 1/4W
R 0029	1	EROS2TKF1000	R:FXD MET FLM 100 OHM 1% 1/4W
R 0030	1	ERDS2TJ102T	R:FXD CARBON 1K OHM 5% 1/4W
R 0031	1	ERDS2TJ471T	R:FXD CARBON 470 OHM 5% 1/4W
R 0032	1	ERDS2TJ471T	R:FXD CARBON 470 OHM 5% 1/4W
R 0033	1	EROS2TKF75R0	R:FXD MET FLM 75.0 OHM 1% 1/4W
R 0034	1	ERDS2TJ223T	R:FXD CARBON 22K OHM 5% 1/4W
R 0035	1	ERDS2TJ472T	R:FXD CARBON 4.7K OHM 5% 1/4W
R 0036	1	ERDS2TJ103T	R:FXD CARBON 10K OHM 5% 1/4W
R 0037	1	EROS2TKF6042	R:FXD MET FLM 60.4K OHM 1% 1/4W
R 0038	1	EROS2TKF4531	R:FXD MET FLM 4.53K OHM 1% 1/4W
R 0039	1	ERDS2TJ821T	R:FXD CARBON 820 OHM 5% 1/4W
R 0040	1	ERDS2TJ470T	R:FXD CARBON 47 OHM 5% 1/4W
R 0041	1	EROS2TKF1740	R:FXD MET FLM 174 OHM 1% 1/4W
R 0042	1	EROS2TKF1740	R:FXD MET FLM 174 OHM 1% 1/4W
R 0043	1	EROS2TKF3480	R:FXD MET FLM 348 OHM 1% 1/4W
R 0044	1	EROS2TKF6491	R:FXD MET FLM 6.49K OHM 1% 1/4W

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REF NO	QTY	PARTS NO	DESCRIPTION	
R 0045	1	ERDS2TJ302T	R:FXD CARBON	3K OHM 5% 1/4W
R 0046	1	EROS2TKF1021	R:FXD MET FLM	1.02K OHM 1% 1/4W
R 0047	1	ERG2ANG391	R:FXD MET OXD	390 OHM 2% 2W
R 0048	1	ERDS2TJ101T	R:FXD CARBON	100 OHM 5% 1/4W
R 0049	1	EROS2TKF75R0	R:FXD MET FLM	75.0 OHM 1% 1/4W
R 0050	1	EROS2TKF6490	R:FXD MET FLM	649 OHM 1% 1/4W
R 0051	1	EROS2TKF6490	R:FXD MET FLM	649 OHM 1% 1/4W
R 0052	1	EROS2TKF3740	R:FXD MET FLM	374 OHM 1% 1/4W
R 0053	1	PK502H501H1T	R:VAR CERMET	500 OHM 20% 1/2W
R 0054	1	EROS2TKF82R5	R:FXD MET FLM	82.5 OHM 1% 1/4W
R 0055	1	EROS2TKF8250	R:FXD MET FLM	825 OHM 1% 1/4W
R 0056	1	ERDS2TJ102T	R:FXD CARBON	1K OHM 5% 1/4W
R 0057	1	ERDS2TJ470T	R:FXD CARBON	47 OHM 5% 1/4W
R 0058	1	EROS2TKF2940	R:FXD MET FLM	294 OHM 1% 1/4W
R 0059	1	EROS2TKF2150	R:FXD MET FLM	215 OHM 1% 1/4W
R 0060	1	ERDS2TJ561T	R:FXD CARBON	560 OHM 5% 1/4W
R 0061	1	ERDS2TJ510T	R:FXD CARBON	51 OHM 5% 1/4W
R 0062	1	ERDS2TJ100T	R:FXD CARBON	10 OHM 5% 1/4W
R 0063	1	EROS2TKF4990	R:FXD MET FLM	499 OHM 1% 1/4W
R 0064	1	ERDS2TJ100T	R:FXD CARBON	10 OHM 5% 1/4W
R 0065	1	EROS2TKF4120	R:FXD MET FLM	412 OHM 1% 1/4W
R 0066	1	ERDS2TJ471T	R:FXD CARBON	470 OHM 5% 1/4W
R 0067	1	ERDS2TJ470T	R:FXD CARBON	47 OHM 5% 1/4W
R 0068	1	ERDS2TJ181T	R.FXD CARBON	180 OHM 5% 1/4W
R 0069	1	ERDS2TJ331T	R:FXD CARBON	330 OHM 5% 1/4W
R 0070	1	ERDS2TJ472T	R:FXD CARBON	4.7K OHM 5% 1/4W
R 0071	1	ERDS2TJ332T	R:FXD CARBON	3.3K OHM 5% 1/4W
R 0072	1	ERDS2TJ220T	R:FXD CARBON	22 OHM 5% 1/4W
R 0073	1	ERDS2TJ102T	R:FXD CARBON	1K OHM 5% 1/4W
R 0074	1	ERDS2TJ102T	R:FXD CARBON	1K OHM 5% 1/4W
R 0075	1	EROS2TKF1000	R:FXD MET FLM	100 OHM 1% 1/4W
R 0076	1	EROS2TKF1000	R:FXD MET FLM	100 OHM 1% 1/4W
R 0077	1	ERDS2TJ472T	R:FXD CARBON	4.7K OHM 5% 1/4W
R 0078	1	ERDS2TJ472T	R:FXD CARBON	4.7K OHM 5% 1/4W
R 0079	1	ERDS2TJ103T	R:FXD CARBON	10K OHM 5% 1/4W
R 0080	1	ERDS2TJ103T	R:FXD CARBON	10K OHM 5% 1/4W
R 0081	1	ERDS2TJ202T	R:FXD CARBON	2K OHM 5% 1/4W
R 0082	1	ERDS2TJ470T	R:FXD CARBON	47 OHM 5% 1/4W
R 0083	1	EROS2TKF4120	R:FXD MET FLM	412 OHM 1% 1/4W
R 0084	1	ERDS2TJ100T	R:FXD CARBON	10 OHM 5% 1/4W
R 0085	1	ERDS2TJ510T	R:FXD CARBON	51 OHM 5% 1/4W
R 0086	1	ERDS2TJ100T	R:FXD CARBON	10 OHM 5% 1/4W

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REF NO	QTY	PARTS NO	DESCRIPTION	
R 0087	1	ERDS2TJ561T	R:FXD CARBON	560 OHM 5% 1/4W
R 0088	1	EROS2TKF2940	R:FXD MET FLM	294 OHM 1% 1/4W
R 0089	1	EROS2TKF2150	R:FXD MET FLM	215 OHM 1% 1/4W
R 0090	1	ERDS2TJ331T	R:FXD CARBON	330 OHM 5% 1/4W
R 0091	1	ERDS2TJ181T	R:FXD CARBON	180 OHM 5% 1/4W
R 0092	1	ERDS2TJ222T	R:FXD CARBON	2.2K OHM 5% 1/4W
R 0093	1	ERDS2TJ472T	R:FXD CARBON	4.7K OHM 5% 1/4W
R 0094	1	ERDS2TJ470T	R:FXD CARBON	47 OHM 5% 1/4W
R 0095	1	ERDS2TJ471T	R:FXD CARBON	470 OHM 5% 1/4W
R 0096	1	ERDS2TJ220T	R:FXD CARBON	22 OHM 5% 1/4W
R 0097	1	ERDS2TJ101T	R:FXD CARBON	100 OHM 5% 1/4W
R 0098	1	EROS2TKF1000	R:FXD MET FLM	100 OHM 1% 1/4W
R 0099	1	EROS2TKF1000	R:FXD MET FLM	100 OHM 1% 1/4W
R 0100	1	ERDS2TJ102T	R:FXD CARBON	1K OHM 5% 1/4W
R 0101	1	ERDS2TJ472T	R:FXD CARBON	4.7K OHM 5% 1/4W
R 0102	1	ERDS2TJ103T	R:FXD CARBON	10K OHM 5% 1/4W
R 0103	1	ERDS2TJ202T	R:FXD CARBON	2K OHM 5% 1/4W
R 0104	1	ERDS2TJ103T	R:FXD CARBON	10K OHM 5% 1/4W
R 0105	1	EROS2TKF1002	R:FXD MET FLM	10.0K OHM 1% 1/4W
R 0106	1	EROS2TKF1002	R:FXD MET FLM	10.0K OHM 1% 1/4W
R 0107	1	EROS2TKF1002	R:FXD MET FLM	10.0K OHM 1% 1/4W
R 0108	1	EROS2TKF1002	R:FXD MET FLM	10.0K OHM 1% 1/4W
R 0109	1	EROS2TKF1002	R:FXD MET FLM	10.0K OHM 1% 1/4W
R 0110	1	EROS2TKF1002	R:FXD MET FLM	10.0K OHM 1% 1/4W
R 0111	1	EROS2TKF1002	R:FXD MET FLM	10.0K OHM 1% 1/4W
R 0112	1	EROS2TKF1002	R:FXD MET FLM	10.0K OHM 1% 1/4W
R 0113	1	EROS2TKF75R0	R:FXD MET FLM	75.0 OHM 1% 1/4W
R 0114	1	ERDS2TJ471T	R:FXD CARBON	470 OHM 5% 1/4W
R 0115	1	EROS2TKF7500	R:FXD MET FLM	750 OHM 1% 1/4W
R 0116	1	EROS2TKF7500	R:FXD MET FLM	750 OHM 1% 1/4W
R 0117	1	EROS2TKF7500	R:FXD MET FLM	750 OHM 1% 1/4W
R 0118	1	EROS2TKF7500	R:FXD MET FLM	750 OHM 1% 1/4W
R 0119	1	ERDS2TJ472T	R:FXD CARBON	4.7K OHM 5% 1/4W
R 0120	1	EROS2TKF7500	R:FXD MET FLM	750 OHM 1% 1/4W
R 0121	1	EROS2TKF7500	R:FXD MET FLM	750 OHM 1% 1/4W
R 0122	1	ERDS2TJ331T	R:FXD CARBON	330 OHM 5% 1/4W
R 0123	1	EROS2TKF7500	R:FXD MET FLM	750 OHM 1% 1/4W
R 0124	1	ERDS2TJ122T	R:FXD CARBON	1.2K OHM 5% 1/4W
R 0125	1	ERDS2TJ122T	R:FXD CARBON	1.2K OHM 5% 1/4W
R 0126	1	ERDS2TJ680T	R:FXD CARBON	68 OHM 5% 1/4W
R 0127	1	EROS2TKF1500	R:FXD MET FLM	150 OHM 1% 1/4W
R 0128	1	EROS2TKF1500	R:FXD MET FLM	150 OHM 1% 1/4W

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REF NO	QTY	PARTS NO	DESCRIPTION	
R 0129	1	EROS2TKF1500	R:FXD MET FLM	150 OHM 1% 1/4W
R 0130	1	EROS2TKF75R0	R:FXD MET FLM	75.0 OHM 1% 1/4W
R 0131	1	EROS2TKF75R0	R:FXD MET FLM	75.0 OHM 1% 1/4W
R 0132	1	EROS2TKF75R0	R:FXD MET FLM	75.0 OHM 1% 1/4W
R 0133	1	EROS2TKF75R0	R:FXD MET FLM	75.0 OHM 1% 1/4W
R 0134	1	EROS2TKF49R9	R:FXD MET FLM	49.9 OHM 1% 1/4W
R 0135	1	EROS2TKF49R9	R:FXD MET FLM	49.9 OHM 1% 1/4W
R 0136	1	EROS2TKF49R9	R:FXD MET FLM	49.9 OHM 1% 1/4W
R 0137	1	EROS2TKF49R9	R:FXD MET FLM	49.9 OHM 1% 1/4W
R 0138	1	EROS2TKF4990	R:FXD MET FLM	499 OHM 1% 1/4W
R 0139	1	EROS2TKF4990	R:FXD MET FLM	499 OHM 1% 1/4W
R 0140	1	EROS2TKF4990	R:FXD MET FLM	499 OHM 1% 1/4W
R 0141	1	ERDS2TJ103T	R:FXD CARBON	10K OHM 5% 1/4W
R 0144	1	ERDS2TJ470T	R:FXD CARBON	47 OHM 5% 1/4W
R 0148	1	EROS2TKF6340	R:FXD MET FLM	634 OHM 1% 1/4W
R 0150	1	EROS2TKF75R0	R:FXD MET FLM	75.0 OHM 1% 1/4W
R 0152	1	ERDS2TJ104T	R:FXD CARBON	100K OHM 5% 1/4W
R 0153	1	EROS2TKF1002	R:FXD MET FLM	10.0K OHM 1% 1/4W
R 0154	1	EROS2TKF7500	R:FXD MET FLM	750 OHM 1% 1/4W
R 0155	1	EROS2TKF33R2	R:FXD MET FLM	33.2 OHM 1% 1/4W
R 0156	1	EROS2TKF33R2	R:FXD MET FLM	33.2 OHM 1% 1/4W
R 0157	1	EROS2TKF7500	R:FXD MET FLM	750 OHM 1% 1/4W
R 0158	1	EROS2TKF4991	R:FXD MET FLM	4.99K OHM 1% 1/4W
R 0159	1	EROS2TKF10R0	R:FXD MET FLM	10 OHM 1% 1/4W
R 0160	1	EROS2TKF1001	R:FXD MET FLM	1K OHM 1% 1/4W
R 0161	1	EROS2TKF1001	R:FXD MET FLM	1K OHM 1% 1/4W
R 0162	1	EROS2TKF1001	R:FXD MET FLM	1K OHM 1% 1/4W
R 0163	1	EROS2TKF1001	R:FXD MET FLM	1K OHM 1% 1/4W
R 0164	1	EROS2TKF8661	R:FXD MET FLM	8.66K OHM 1% 1/4W
R 0165	1	EROS2TKF4991	R:FXD MET FLM	4.99K OHM 1% 1/4W
R 0166	1	EROS2TKF4221	R:FXD MET FLM	4.22K OHM 1% 1/4W
R 0167	1	EROS2TKF4022	R:FXD MET FLM	40.2K OHM 1% 1/4W
R 0168	1	ERDS2TJ513T	R:FXD CARBON	51K OHM 5% 1/4W
R 0169	1	ERDS2TJ203T	R:FXD CARBON	20K OHM 5% 1/4W
R 0170	1	ERDS2TJ104T	R:FXD CARBON	100K OHM 5% 1/4W
R 0171	1	EROS2TKF8060	R:FXD MET FLM	806 OHM 1% 1/4W
R 0172	1	EROS2TKF4321	R:FXD MET FLM	4.32K OHM 1% 1/4W
R 0173	1	EROS2TKF1001	R.FXD MET FLM	1K OHM 1% 1/4W
R 0174	1	EROS2TKF4991	R:FXD MET FLM	4.99K OHM 1% 1/4W
R 0175	1	EROS2TKF4991	R:FXD MET FLM	4.99K OHM 1% 1/4W
R 0176	1	ERDS2TJ105T	R:FXD CARBON	1M OHM 5% 1/4W
R 0177	1	ERDS2TJ473T	R:FXD CARBON	47K OHM 5% 1/4W

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REF NO	QTY	PARTS NO	DESCRIPTION	
R 0178	1	EROS2TKF2211	R:FXD MET FLM	2.21K OHM 1% 1/4W
R 0179	1	EROS2TKF3320	R:FXD MET FLM	332 OHM 1% 1/4W
R 0180	1	EROS2TKF2490	R:FXD MET FLM	249 OHM 1% 1/4W
R 0181	1	EROS2TKF2002	R:FXD MET FLM	20.0K OHM 1% 1/4W
R 0182	1	EROS2TKF1003	R:FXD MET FLM	100K OHM 1% 1/4W
R 0183	1	EROS2TKF1000	R:FXD MET FLM	100 OHM 1% 1/4W
R 0184	1	POT3106W1202	R:VAR	2K OHM 10% 1/2W
R 0185	1	EROS2TKF2002	R:FXD MET FLM	20.0K OHM 1% 1/4W
R 0186	1	EROS2TKF3922	R:FXD MET FLM	39.2K OHM 1% 1/4W
R 0187	1	EROS2TKF1000	R:FXD MET FLM	100 OHM 1% 1/4W
R 0188	1	ERDS2TJ222T	R:FXD CARBON	2.2K OHM 5% 1/4W
R 0189	1	ERDS2TJ103T	R:FXD CARBON	10K OHM 5% 1/4W
R 0190	1	ERDS2TJ332T	R:FXD CARBON	3.3K OHM 5% 1/4W
R 0192	1	ERDS2TJ273T	R:FXD CARBON	27K OHM 5% 1/4W
R 0193	1	ERDS2TJ152T	R:FXD CARBON	1.5K OHM 5% 1/4W
R 0194	1	ERDS2TJ182T	R:FXD CARBON	1.8K OHM 5% 1/4W
R 0195	1	ERDS2TJ152T	R:FXD CARBON	1.5K OHM 5% 1/4W
R 0196	1	ERDS2TJ152T	R:FXD CARBON	1.5K OHM 5% 1/4W
R 0197	1	ERDS2TJ102T	R:FXD CARBON	1K OHM 5% 1/4W
R 0198	1	EROS2TKF1002	R:FXD MET FLM	10.0K OHM 1% 1/4W
R 0199	1	EROS2TKF2001	R:FXD MET FLM	2.00K OHM 1% 1/4W
R 0200	1	ERDS2TJ752T	R:FXD CARBON	7.5K OHM 5% 1/4W
R 0201	1	ERDS2TJ302T	R:FXD CARBON	3K OHM 5% 1/4W
R 0202	1	ERDS2TJ183T	R:FXD CARBON	18K OHM 5% 1/4W
R 0203	1	ERDS2TJ684T	R:FXD CARBON	680K OHM 5% 1/4W
R 0204	1	ERDS2TJ472T	R:FXD CARBON	4.7K OHM 5% 1/4W
R 0205	1	ERDS2TJ472T	R:FXD CARBON	4.7K OHM 5% 1/4W
R 0206	1	ERDS2TJ472T	R:FXD CARBON	4.7K OHM 5% 1/4W
R 0207	1	ERDS2TJ472T	R:FXD CARBON	4.7K OHM 5% 1/4W
R 0208	1	ERDS2TJ472T	R:FXD CARBON	4.7K OHM 5% 1/4W
R 0209	1	ERDS2TJ472T	R:FXD CARBON	4.7K OHM 5% 1/4W
R 0210	1	ERDS2TJ332T	R:FXD CARBON	3.3K OHM 5% 1/4W
R 0211	1	ERDS2TJ101T	R:FXD CARBON	100 OHM 5% 1/4W
R 0212	1	ERDS2TJ471T	R:FXD CARBON	470 OHM 5% 1/4W
R 0213	1	ERDS2TJ562T	R:FXD CARBON	5.6K OHM 5% 1/4W
R 0214	1	ERDS2TJ152T	R:FXD CARBON	1.5K OHM 5% 1/4W
R 0215	1	ERDS2TJ512T	R:FXD CARBON	5.1K OHM 5% 1/4W
R 0216	1	ERDS2TJ102T	R:FXD CARBON	1K OHM 5% 1/4W
R 0217	1	ERDS2TJ274T	R:FXD CARBON	270K OHM 5% 1/4W
R 0218	1	ERDS2TJ152T	R:FXD CARBON	1.5K OHM 5% 1/4W
R 0219	1	ERDS2TJ472T	R:FXD CARBON	4.7K OHM 5% 1/4W
R 0220	1	ERDS2TJ105T	R:FXD CARBON	1M OHM 5% 1/4W

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REF NO	QTY	PARTS NO	DESCRIPTION	
R 0221	1	ERDS2TJ105T	R:FXD CARBON	1M OHM 5% 1/4W
R 0222	1	ERDS2TJ101T	R:FXD CARBON	100 OHM 5% 1/4W
R 0223	1	EROS2TKF2741	R:FXD MET FLM	2.74K OHM 1% 1/4W
R 0224	1	ERDS2TJ104T	R:FXD CARBON	100K OHM 5% 1/4W
R 0225	1	ERDS2TJ223T	R:FXD CARBON	22K OHM 5% 1/4W
R 0226	1	ERDS2TJ302T	R:FXD CARBON	3K OHM 5% 1/4W
R 0227	1	ERDS2TJ123T	R:FXD CARBON	12K OHM 5% 1/4W
R 0228	1	ERDS2TJ104T	R:FXD CARBON	100K OHM 5% 1/4W
R 0229	1	ERDS2TJ102T	R:FXD CARBON	1K OHM 5% 1/4W
R 0230	1	EROS2TKF5761	R:FXD MET FLM	5.76K OHM 1% 1/4W
R 0231	1	EROS2TKF4221	R:FXD MET FLM	4.22K OHM 1% 1/4W
R 0232	1	ERDS2TJ103T	R:FXD CARBON	10K OHM 5% 1/4W
R 0233	1	ERDS2TJ103T	R:FXD CARBON	10K OHM 5% 1/4W
R 0234	1	ERDS2TJ102T	R:FXD CARBON	1K OHM 5% 1/4W
R 0235	1	EROS2TKF1003	R:FXD MET FLM	100K OHM 1% 1/4W
R 0236	1	ERDS2TJ103T	R:FXD CARBON	10K OHM 5% 1/4W
R 0237	1	ERDS2TJ104T	R:FXD CARBON	100K OHM 5% 1/4W
R 0238	1	ERDS2TJ182T	R:FXD CARBON	1.8K OHM 5% 1/4W
R 0239	1	ERDS2TJ103T	R:FXD CARBON	10K OHM 5% 1/4W
R 0240	1	ERDS2TJ472T	R:FXD CARBON	4.7K OHM 5% 1/4W
R 0241	1	ERDS2TJ472T	R:FXD CARBON	4.7K OHM 5% 1/4W
R 0242	1	ERDS2TJ472T	R:FXD CARBON	4.7K OHM 5% 1/4W
R 0243	1	ERDS2TJ472T	R:FXD CARBON	4.7K OHM 5% 1/4W
R 0244	1	ERDS2TJ103T	R:FXD CARBON	10K OHM 5% 1/4W
R 0245	1	ERDS2TJ153T	R:FXD CARBON	15K OHM 5% 1/4W
R 0246	1	ERDS2TJ103T	R:FXD CARBON	10K OHM 5% 1/4W
R 0247	1	ERDS2TJ512T	R:FXD CARBON	5.1K OHM 5% 1/4W
R 0248	1	ERDS2TJ102T	R:FXD CARBON	1K OHM 5% 1/4W
R 0249	1	ERDS2TJ103T	R:FXD CARBON	10K OHM 5% 1/4W
R 0250	1	ERDS2TJ102T	R:FXD CARBON	1K OHM 5% 1/4W
R 0251	1	ERDS2TJ332T	R:FXD CARBON	3.3K OHM 5% 1/4W
R 0252	1	ERDS2TJ101T	R:FXD CARBON	100 OHM 5% 1/4W
R 0253	1	ERDS2TJ332T	R:FXD CARBON	3.3K OHM 5% 1/4W
R 0254	1	ERDS2TJ471T	R:FXD CARBON	470 OHM 5% 1/4W
R 0255	1	ERDS2TJ272T	R:FXD CARBON	2.7K OHM 5% 1/4W
R 0256	1	ERDS2TJ472T	R:FXD CARBON	4.7K OHM 5% 1/4W
R 0257	1	ERDS2TJ222T	R:FXD CARBON	2.2K OHM 5% 1/4W
R 0258	1	ERDS2TJ101T	R:FXD CARBON	100 OHM 5% 1/4W
R 0259	1	ERDS2TJ472T	R:FXD CARBON	4.7K OHM 5% 1/4W
R 0260	1	ERDS2TJ332T	R.FXD CARBON	3.3K OHM 5% 1/4W
R 0261	1	ERDS2TJ102T	R:FXD CARBON	1K OHM 5% 1/4W
R 0262	1	EROS2TKF1182	R:FXD MET FLM	11.8K OHM 1% 1/4W

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REF NO	QTY	PARTS NO	DESCRIPTION	
R 0263	1	EROS2TKF2000	R:FXD MET FLM	200 OHM 1% 1/4W
R 0264	1	ERDS2TJ471T	R:FXD CARBON	470 OHM 5% 1/4W
R 0265	1	ERDS2TJ104T	R:FXD CARBON	100K OHM 5% 1/4W
R 0266	1	ERDS2TJ472T	R:FXD CARBON	4.7K OHM 5% 1/4W
R 0267	1	ERDS2TJ823T	R:FXD CARBON	82K OHM 5% 1/4W
R 0268	1	ERDS2TJ622T	R:FXD CARBON	6.2K OHM 5% 1/4W
R 0269	1	ERDS2TJ105T	R:FXD CARBON	1M OHM 5% 1/4W
R 0270	1	EROS2TKF3011	R:FXD MET FLM	3.01K OHM 1% 1/4W
R 0271	1	EROS2TKF6981	R:FXD MET FLM	6.98K OHM 1% 1/4W
R 0272	1	EROS2TKF2001	R:FXD MET FLM	2.00K OHM 1% 1/4W
R 0273	1	ERDS2TJ103T	R:FXD CARBON	10K OHM 5% 1/4W
R 0274	1	ERDS2TJ221T	R:FXD CARBON	220 OHM 5% 1/4W
R 0275	1	ERDS2TJ221T	R:FXD CARBON	220 OHM 5% 1/4W
R 0276	1	ERDS2TJ103T	R:FXD CARBON	10K OHM 5% 1/4W
R 0277	1	ERDS2TJ822T	R:FXD CARBON	8.2K OHM 5% 1/4W
R 0278	1	ERDS2TJ103T	R:FXD CARBON	10K OHM 5% 1/4W
R 0279	1	ERDS2TJ105T	R:FXD CARBON	1M OHM 5% 1/4W
R 0280	1	ERDS2TJ103T	R:FXD CARBON	10K OHM 5% 1/4W
R 0281	1	ERDS2TJ332T	R:FXD CARBON	3.3K OHM 5% 1/4W
R 0282	1	ERDS2TJ753T	R:FXD CARBON	75K OHM 5% 1/4W
R 0283	1	EROS2TKF1622	R:FXD MET FLM	16.2K OHM 1% 1/4W
R 0284	1	ERDS2TJ104T	R:FXD CARBON	100K OHM 5% 1/4W
R 0285	1	ERDS2TJ104T	R:FXD CARBON	100K OHM 5% 1/4W
R 0286	1	ERDS2TJ105T	R:FXD CARBON	1M OHM 5% 1/4W
R 0287	1	ERDS2TJ331T	R:FXD CARBON	330 OHM 5% 1/4W
R 0288	1	ERDS2TJ105T	R:FXD CARBON	1M OHM 5% 1/4W
R 0289	1	ERDS2TJ471T	R:FXD CARBON	470 OHM 5% 1/4W
R 0290	1	ERDS2TJ511T	R:FXD CARBON	510 OHM 5% 1/4W
R 0291	1	PK502H202H1T	R:VAR CERMET	2K OHM 20 1/2W
R 0292	1	PK502H202H1T	R:VAR CERMET	2K OHM 20 1/2W
R 0293	1	PK502H202H1T	R:VAR CERMET	2K OHM 20 1/2W
R 0294	1	PK502H202H1T	R:VAR CERMET	2K OHM 20 1/2W
R 0295	1	PK502H201H1T	R:VAR CERMET	200 OHM 20% 1/2W
R 0296	1	PK502H201H1T	R:VAR CERMET	200 OHM 20% 1/2W
R 0297	1	PK502H101H1T	R:VAR CERMET	100 OHM 20% 1/2W
R 0298	1	PK502H500H1T	R:VAR CERMET	500 OHM 20% 1/2W
R 0299	1	PK502H500H1T	R:VAR CERMET	500 OHM 20% 1/2W
R 0300	1	PK502H502H1T	R:VAR CERMET	5K OHM 20% 1/2W
R 0301	1	PK502H502H1T	R:VAR CERMET	5K OHM 20% 1/2W
R 0302	1	PK502H503H1T	R:VAR CERMET	50K OHM +-20% 1/8W
R 0303	1	POT3106W1501	R:VAR	500 OHM 10% 1/2W
R 0304	1	PK502H103H1T	R:VAR CERMET	10K OHM 20% 1/2W

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REF NO	QTY	PARTS NO	DESCRIPTION	
R 0305	1	PK502H201H1T	R:VAR CERMET	200 OHM 20% 1/2W
R 0307	1	PK502H503H1T	R:VAR CERMET	50K OHM +-20% 1/8W
R 0308	1	POT3106W1501	R:VAR	500 OHM 10% 1/2W
R 0309	1	POT3106W1202	R:VAR	2K OHM 10% 1/2W
R 0310	1	POT3106W1202	R:VAR	2K OHM 10% 1/2W
R 0311	1	EXBF9E472J	R:NETWORK	4.7K OHM X8 5% 1/8W : P
R 0312	1	EXBF9E472J	R:NETWORK	4.7K OHM X8 5% 1/8W : P
R 0400	1	ERDS2TJ471T	R:FXD CARBON	470 OHM 5% 1/4W
R 0401	1	ERDS2TJ471T	R:FXD CARBON	470 OHM 5% 1/4W
RT 0001	1	ERTD2FGL202S	THERMISTOR	2K OHM 15%
U 0001	1	74HC163	IC:HS-CMOS	FULLY SYNC.4-BIT COU
U 0002	1	74HC163	IC:HS-CMOS	FULLY SYNC.4-BIT COU
U 0003	1	74HC157	IC:HS-CMOS	QUAD 2-1 DATA SELECT/MPX
U 0004	1	UPD71054C	IC:C MOS	PROG INTERBAL TIMER
U 0005	1	UPD71054C	IC:C MOS	PROG INTERBAL TIMER
U 0006	1	74HC157	IC:HS-CMOS	QUAD 2-1 DATA SELECT/MPX
U 0007	1	74HC161	IC:HS-CMOS	SYNC.4-BIT COUNTER
U 0008	1	74HC74	IC:HS-CMOS	DUAL D-TYPE F/F
U 0009	1	74HC10	IC:HS-CMOS	TRIPLE 3-NAND
U 0010	1	74HC32	IC:HS-CMOS	QUAD 2-OR
U 0011	1	74HC00	IC:HS-CMOS	QUAD 2-NAND
U 0012	1	74HC123	IC:HS CMOS	DUAL RETRIGG MONO MU
U 0013	1	74HC74	IC:HS-CMOS	DUAL D-TYPE F/F
U 0014	1	74HC163	IC:HS-CMOS	FULLY SYNC.4-BIT COU
U 0015	1	74HC157	IC:HS-CMOS	QUAD 2-1 DATA SELECT/MPX
U 0016	1	HM6264ALSP15	IC:C MOS	
U 0017	1	LM1881N	IC:LINEAR	VIDEO SYNC SEPA
U 0018	1	HM62832P-45	IC:C MOS	SRAM 32KX8 45NS
U 0019	1	74HC157	IC:HS-CMOS	QUAD 2-1 DATA SELECT/MPX
U 0020	1	74HC161	IC:HS-CMOS	SYNC.4-BIT COUNTER
U 0021	1	74HC74	IC:HS-CMOS	DUAL D TYPE F/F
U 0022	1	74HC190	IC:HS-CMOS	SYNC.U/D DECADE COUNTER
U 0023	1	74HC190	IC:HS-CMOS	SYNC.U/D DECADE COUNTER
U 0024	1	74HC190	IC:HS-CMOS	SYNC.U/D DECADE COUNTER
U 0025	1	74HC190	IC:HS-CMOS	SYNC.U/D DECADE COUNTER
U 0026	1	74HC74	IC:HS-CMOS	DUAL D-TYPE F/F
U 0027	1	74HC163	IC:HS-CMOS	FULLY SYNC.4-BIT COU
U 0028	1	74HC157	IC:HS-CMOS	QUAD 2-1 DATA SELECT/MPX
U 0029	1	74HC74	IC:HS-CMOS	DUAL D-TYPE F/F
U 0030	1	74HC157	IC:HS-CMOS	QUAD 2-1 DATA SELECT/MPX
U 0031	1	74HC161	IC:HS-CMOS	SYNC.4-BIT COUNTER

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REF NO	QTY	PARTS NO	DESCRIPTION	
U 0032	1	74HC08	IC:HS-CMOS	QUAD 2-AND
U 0033	1	74HC74	IC:HS-CMOS	DUAL D-TYPE F/F
U 0034	1	74HC190	IC:HS-CMOS	SYNC.U/D DECADE COUNTER
U 0035	1	74HC190	IC:HS-CMOS	SYNC.U/D DECADE COUNTER
U 0036	1	74HC74	IC:HS-CMOS	DUAL D-TYPE F/F
U 0037	1	74HC74	IC:HS-CMOS	DUAL D-TYPE F/F
U 0038	1	74HC153	IC:HS-CMOS	DUAL 4-1 DATA SELECT
U 0039	1	74HC157	IC:HS-CMOS	QUAD 2-1 DATA SELECT/MPX
U 0040	1	74HC04	IC:HS-CMOS	HEX INVERTER
U 0041	1	74HC02	IC:HS-CMOS	QUAD 2-NOR
U 0042	1	74HC112	IC:HS-CMOS	DUAL J-K F/F (PR,CLR
U 0043	1	74HC08	IC:HS-CMOS	QUAD 2-AND
U 0044	1	74HC157	IC:HS-CMOS	QUAD 2-1 DATA SELECT/MPX
U 0045	1	74F00PC	IC:FAST	QUAD 2-INPUT NAND GATE
U 0046	1	74HC10	IC:HS-CMOS	TRIPLE 3-NAND
U 0047	1	74HC123	IC:HS-CMOS	DUAL RETRIGG MONO MU
U 0048	1	74HC04	IC:HS-CMOS	HEX INVERTER
U 0049	1	74HC112	IC:HS-CMOS	DUAL J-K F/F (PR,CLR
U 0050	1	74HC00	IC:HS-CMOS	QUAD 2-NAND
U 0051	1	MC4044P	IC:TTL	FREQ DETECTOR
U 0052	1	74HC123	IC:HS-CMOS	DUAL RETRIGG MONO MU
U 0053	1	74HC32	IC:HS-CMOS	QUAD 2-OR
U 0054	1	74HC245	IC:HS-CMOS	OCTAL TRI-STATE TRAN
U 0055	1	74HC245	IC:HS-CMOS	OCTAL TRI-STATE TRAN
U 0056	1	74HC574	IC:HS-CMOS	OCTAL TRI-STATE D-F/F
U 0057	1	74HC123	IC:HS-CMOS	DUAL RETRIGG MONO MU
U 0058	1	74HC08	IC:HS-CMOS	QUAD 2-AND
U 0059	1	74F163PC	IC:FAST	COUNTER
U 0060	1	TC74HCU04AP	IC:C MOS	HEX INVERTER
U 0061	1	TC74HCU04AP	IC:C MOS	HEX INVERTER
U 0062	1	74F164PC	IC:FAST	SHIFT REGISTOR
U 0063	1	74F04PC	IC:FAST	HEX INVERTER
U 0064	1	74F163PC	IC:FAST	COUNTER
U 0065	1	74F163PC	IC:FAST	COUNTER
U 0066	1	74F08PC	IC:FAST	QUAD 2-INPUT AND GATE
U 0067	1	74F112PC	IC:FAST	DUAL J-K F/F
U 0068	1	74F74PC	IC:FAST	DUAL D-TYPE FLIP-FLOP
U 0069	1	74HC157	IC:HS-CMOS	QUAD 2-1 DATA SELECT/MPX
U 0070	1	74HC00	IC:HS-CMOS	QUAD 2-NAND
U 0071	1	74HC00	IC:HS-CMOS	QUAD 2-NAND
U 0072	1	TC74HCU04AP	IC:C MOS	HEX INVERTER
U 0073	1	AD7523JN	IC:C MOS	8BIT DA CONVERTER

P8450A ANALOG DWG NO 4G208619

REF NO	QTY	PARTS NO	DESCRIPTION	
U 0074	1	74HC574	IC:HS-CMOS	OCTAL TRI-STATE D-F/F
U 0075	1	74HC4053	IC:HS-CMOS	TRIPLE 2CHAN ANALOG
U 0076	1	74HC4053	IC:HS-CMOS	TRIPLE 2CHAN ANALOG
U 0083	1	74HC4052	IC:HS-CMOS	DUAL 4CHANNEL ANALOG
U 0084	1	EL2020CN	IC:OP AMP	HIGH SPEED
U 0085	1	EL2020CN	IC:OP AMP	HIGH SPEED
U 0086	1	EL2003CN	IC:OP AMP	HIGH SPEED
U 0087	1	EL2020CN	IC:OP AMP	HIGH SPEED
U 0088	1	UPC649C	IC:OP AMP	SAMPLE AND HOLD
U 0089	1	NJM082BD-A	IC:OP AMP	BI-FET DUAL
U 0090	1	NJM082BD-A	IC:OP AMP	BI-FET DUAL
U 0091	1	NJM082BD-A	IC:OP AMP	BI-FET DUAL
U 0092	1	EL2020CN	IC:OP AMP	HIGH SPEED
U 0095	1	EL2003CN	IC:OP AMP	HIGH SPEED
U 0096	1	EL2003CN	IC:OP AMP	HIGH SPEED
U 0097	1	EL2003CN	IC:OP AMP	HIGH SPEED
U 0098	1	EL2003CN	IC:OP AMP	HIGH SPEED
U 0099	1	THC4231	IC:OP AMP	165MHZ 100MA OUT
U 0100	1	OP200GP	IC:OP AMP DUAL	PRECISION (OP77 X2)
U 0101	1	TDC1020J1C	IC:LINEAR	
U 0102	1	74F174PC	IC:FAST	
U 0103	1	74F174PC	IC:FAST	
U 0104	1	TD62307P	IC:DRIVER	7LINE RELAY DRIVER
U 0105	1	TD62307P	IC:DRIVER	7LINE RELAY DRIVER
U 0106	1	CA3080	IC:OP AMP	TRANSCONDUCTANCE AMP
U 0107	1	TL081CP	IC:OP AMP	BI-FET
U 0108	1	AD7523JN	IC:C MOS	8BIT DA CONVERTER
U 0109	1	NJM082BD-A	IC:OP AMP	BI-FET DUAL
U 0110	1	TL081CP	IC:OP AMP	BI-FET
U 0111	1	NJM082BD-A	IC:OP AMP	BI-FET DUAL
U 0113	1	UPC7912H	IC:V RGLTR	-12V 1A
U 0114	1	UPC7905HF	IC:V RGLTR	
U 0115	1	NJM78M12F-A	IC:V RGLTR	+12V 0.5A
U 0116	1	UPC7805HF	IC:V RGLTR	
U 0117	1	UPC7812H	IC:V RGLTR	+12V 1A
U 0118	1	EL2002CN	IC:BUFFER AMP	180MHZ
U 0119	1	EL2002CN	IC:BUFFER AMP	180MHZ
U 0120	1	EL2002CN	IC:BUFFER AMP	180MHZ
U 0121	1	EL2002CN	IC:BUFFER AMP	180MHZ
U 0122	1	EL2002CN	IC:BUFFER AMP	180MHZ
U 0123	1	NJM082BD-A	IC:OP AMP	BI-FET DUAL
U 0124	1	EL2002CN	IC:BUFFER AMP	180MHZ

P8450A ANALOG DWG NO 4G208619

REF NO	QTY	PARTS NO	DESCRIPTION	
U 0125	1	EL2030CN	IC:VIDEO AMP	120MHZ
U 0126	1	EL2002CN	IC:BUFFER AMP	180MHZ
U 0129	1	NJM082BD-A	IC:OP AMP	BI-FET DUAL
U 0130	1	UPC393C	IC:LINEAR	DUAL COMPARATOR
U 0131	1	NJM082BD-A	IC:OP AMP	BI-FET DUAL
U 0132	1	LM306H	IC:COMPARATOR	
U 0133	1	UPC271C	IC:COMPARATOR	
U 0134	1	UPC649C	IC:OP AMP	SAMPLE AND HOLD
U 0135	1	NJM082BD-A	IC:OP AMP	BI-FET DUAL
U 0136	1	UPC271C	IC:COMPARATOR	
VR 0002	1	LM313H	DIODE:ZENER	
VR 0004	1	RD5.1EB2	DIODE:ZENER	5.1V 500MW
VR 0005	1	RD3.9EB2	DIODE:ZENER	3.7V 500MW
XU 0101	1	DILB64P-8JL	IC SOCKET	64-PIN DIL
Y 0001	1	4G461972	17.7MHZ X'TAL	P8450A
Y 0002	1	4G461971	14.3MHZ X'TAL	P8450A

P8450A PANEL DWG NO 4G208620

REF NO	QTY	PARTS NO	DESCRIPTION	
C 0001	1	ECUV1H221JCN	C:FXD CHIP	220PF +-5% 50V NPO
C 0002	1	ECUV1H221JCN	C:FXD CHIP	220PF +-5% 50V NPO
C 0003	1	ECUV1H221JCN	C:FXD CHIP	220PF +-5% 50V NPO
C 0004	1	ECUV1H221JCN	C:FXD CHIP	220PF +-5% 50V NPO
C 0005	1	ECUV1H221JCN	C:FXD CHIP	220PF +-5% 50V NPO
C 0006	1	ECUV1H221JCN	C:FXD CHIP	220PF +-5% 50V NPO
C 0007	1	ECUV1H221JCN	C:FXD CHIP	220PF +-5% 50V NPO
C 0008	1	ECUV1H221JCN	C:FXD CHIP	220PF +-5% 50V NPO
C 0009	1	ECUV1H221JCN	C:FXD CHIP	220PF +-5% 50V NPO
C 0010	1	ECUV1H221JCN	C:FXD CHIP	220PF +-5% 50V NPO
C 0011	1	ECUV1H221JCN	C:FXD CHIP	220PF +-5% 50V NPO
C 0012	1	ECUV1H221JCN	C:FXD CHIP	220PF +-5% 50V NPO
C 0013	1	ECUV1H221JCN	C:FXD CHIP	220PF +-5% 50V NPO
C 0014	1	ECUV1H221JCN	C:FXD CHIP	220PF +-5% 50V NPO
C 0015	1	ECUV1H221JCN	C:FXD CHIP	220PF +-5% 50V NPO
C 0016	1	ECUV1H221JCN	C:FXD CHIP	220PF +-5% 50V NPO
C 0017	1	ECEV0JV101SP	C:FXD AL ELECT	100U +-20% 6.3V
C 0018	1	ECUV1E104ZFG	C:FXD CHIP	0.1UF +80-20 25V F
C 0019	1	ECUV1E104ZFG	C:FXD CHIP	0.1UF +80-20 25V F
C 0020	1	ECUV1E104ZFG	C:FXD CHIP	0.1UF +80-20 25V F
C 0021	1	ECUV1E104ZFG	C:FXD CHIP	0.1UF +80-20 25V F
C 0022	1	ECUV1E104ZFG	C:FXD CHIP	0.1UF +80-20 25V F
C 0023	1	ECUV1E104ZFG	C:FXD CHIP	0.1UF +80-20 25V F
C 0024	1	ECUV1E104ZFG	C:FXD CHIP	0.1UF +80-20 25V F
C 0025	1	ECUV1E104ZFG	C:FXD CHIP	0.1UF +80-20 25V F
E	1	3G401951	PCB,PANEL	P8450A
J 0001	1	EMCS1052M	CONNECTOR	10P STRAIGHT
J 0002	1	EMCS0552M	CONNECTOR PIN	5PIN STRAIGHT
MP	3	4G690730-0EB	SPACER,CLAMP	0443BS42 CRS-3
R 0001	1	EXBM16V471J	R:NETWORK	470 OHM X8 5% 1/16W
R 0002	1	ERJ6GMYJ681V	R:FXD CHIP CARBON	680 OHM 5% 1/10W
R 0003	1	ERJ6GMYJ683V	R:FXD CHIP CARB	68K OHM 5% 1/10W
R 0004	1	ERJ6GMYJ683V	R:FXD CHIP CARB	68K OHM 5% 1/10W
S 0002	1	HL21CNS	PUSH SWITCH	
S 0003	1	HL21CNS	PUSH SWITCH	
S 0004	1	HL21CNS	PUSH SWITCH	
S 0005	1	HL21CNS	PUSH SWITCH	
S 0006	1	HL21CNS	PUSH SWITCH	
S 0007	1	HL21CNS	PUSH SWITCH	
S 0008	1	HL21CNS	PUSH SWITCH	

P8450A PANEL DWG NO 4G208620

REF NO	QTY	PARTS NO	DESCRIPTION	
S 0009	1	HL21CNS	PUSH SWITCH	
S 0010	1	HL21CNS	PUSH SWITCH	
S 0011	1	HL21CNS	PUSH SWITCH	
S 0012	1	HL21C-LSA	PUSH SWITCH	LED:AMBER
S 0013	1	HL21CNS	PUSH SWITCH	
S 0014	1	HL21CNS	PUSH SWITCH	
S 0015	1	HL21CNS	PUSH SWITCH	
S 0016	1	HL21CNS	PUSH SWITCH	
S 0017	1	HL21C-LSA	PUSH SWITCH	LED:AMBER
S 0018	1	HL21CNS	PUSH SWITCH	
S 0019	1	HL21CNS	PUSH SWITCH	
S 0020	1	HL21CNS	PUSH SWITCH	
S 0021	1	HL21CNS	PUSH SWITCH	
S 0022	1	HL21C-LSA	PUSH SWITCH	LED:AMBER
S 0023	1	HL21CNS	PUSH SWITCH	
S 0024	1	HL21CNS	PUSH SWITCH	
S 0025	1	HL21CNS	PUSH SWITCH	
S 0026	1	HL21CNS	PUSH SWITCH	
S 0027	1	HL21C-LSA	PUSH SWITCH	LED:AMBER
S 0028	1	HL21C-LSA	PUSH SWITCH	LED:AMBER
S 0033	1	EVQWL1001	JOG ENCODER	
U 0001	1	UPD65012G227	GATE ARRAY:CMOS	PANEL INTERFACE
U 0002	1	74HC74S	IC:HS-CMOS SO PACKAGE	DUAL D-TYPE F/F
U 0003	1	74HC08S	IC:HS-CMOS SO P	QUAD 2-AND
U 0004	1	74HC14S	IC:HS-CMOS SO PACKAGE	HEX INV. SCHMITT TRG

P8450A REMOTE DWG NO 4G208621

REF NO	QTY	PARTS NO	DESCRIPTION	
E 0001	1	3G401950-1	PCB,REMOTE	P8450A
J 0001	1	SLEM30R-2	CONNECTOR:ZIFLO	30P RIGHT ANGLE
J 0002	1	SLEM30R-2	CONNECTOR:ZIFLO	30P RIGHT ANGLE
J 0003	1	4G470851	P8253A CONNECTO	57LE-20240-7700-D35G
J 0004	1	RC10-36R-LW	CONNECTOR : CNT	36P SOCKET
MP	1	3G614379-0WB	PLT:PCB REMOTE	P8450A

P8450A LCD ASSY DWG NO 4G208679

REF NO	QTY	PARTS NO	DESCRIPTION	
A 0003	1	TLX-711A-E0	LCD MODULE	240X64 DOTS GRAPHIC
J 0003	1	65611-120	HEADER	20P
W	1	4G471315	CABLE 8	P8450A

P8450A CABLE DWG NO 4G208680

REF NO	QTY	PARTS NO	DESCRIPTION	
E	1	170781-1	TERMINAL:PLASTI	4.4MMID AWG22-18
E	13	171512-2	TERMINAL:PLASTI	3.02MMID AWG22-18
E	44	48051	CONNECTOR	PV TERMINAL (REEL TY
P	4	3448-7960	CONNECTOR:SOCKET	60P TYPE 79
P 0009	1	65043-027	CONNECTOR	DUAL LATCH HOUSING
P 0013	1	65039-034	CONNECTOR	LATCH HOUSING
P 0014	1	65039-034	CONNECTOR	LATCH HOUSING
P 0015	1	7960-6500SC	CONNECTOR:SOCKET	60P TYPE 79
P 0016	1	7960-6500SC	CONNECTOR:SOCKET	60P TYPE 79
P 0017	1	65043-027	CONNECTOR	DUAL LATCH HOUSING
P 0017	1	7960-6500SC	CONNECTOR:SOCKET	60P TYPE 79
P 0018	1	7960-6500SC	CONNECTOR:SOCKET	60P TYPE 79
P 0019	1	EMCM1010D65V	CONNECTOR	10P L=100MM
W 0002	1	4G471297	CABLE:CARD	P8450A
W 0003	1	4G471297	CABLE:CARD	P8450A
W 0004	1	4G471302	CABLE 4	P8450A
W 0005	1	4G471303	CABLE 5	P8450A
W 0006	1	4G471303	CABLE 5	P8450A
W 0007	1	4G471304	CABLE 6	P8450A
W 0008	1	4G471304	CABLE 6	P8450A
W 0009	1	4G471304	CABLE 6	P8450A
W 0010	1	4G471304	CABLE 6	P8450A
W 0011	1	4G471303	CABLE 5	P8450A
W 0012	1	4G471304	CABLE 6	P8450A
W 0013	1	4G471304	CABLE 6	P8450A
W 0014	1	4G471304	CABLE 6	P8450A
W 0015	1	4G471300	CABLE 2	P8450A
W 0017	1	4G471299	CABLE 1	P8450A
W 0018	1	EMCM0540D65V	CABLE	5P L=400MM
W 0020	1	4G471310	CABLE 7	P8450A

P8450A FAN ASSY DWG NO 4G208681

REF NO	QTY	PARTS NO	DESCRIPTION	
BF 0001	1	FBK08A12HE	FAN	DC 12V 0.19AMAX 80X
E	2	EMCKNM05D	CONNECTOR	PIN
P 0003	1	EMCHUM0201W	CONNECTOR	LATCH HOUSING 2PIN

P8450A REAR PAN DWG NO 4G208682

REF NO	QTY	PARTS NO	DESCRIPTION	
C 0001	1	ECKDKS472ZV	C:FXD CER HI-K	4700PF +80.-20% 400V
E	1	170782-1	TERMINAL:PLASTI	4.3 MMID AWG16-14
E	2	171512-2	TERMINAL:PLASTI	3.02MMID AWG22-18
J 0001	1	CM11	CONNECTOR	PWR JACK 3P
MP	1	2G581015-0CH	PLATE,REAR	P8450A
MP	1	4G617086-0AB	PLATE:SLIDE SW	P5512A
MP	1	4G618435-0BB	HOLDER.POWER SW	P7752A
MP	1	4G634938-0L	LABEL	PROTECTIVE EARTH
MP	4	4G760757-0G	*FOOT,REAR	
S 0001	1	ESB70702V	PUSHB SW	DPST 3A-250V AC
S 0002	1	ESD39715A	LEVER SW	50A/40A 250VAC
W 0003	1	BNC216	CONNECTOR	BNC
W 0004	1	BNC216	CONNECTOR	BNC
W 0005	1	BNC216	CONNECTOR	BNC
W 0006	1	BNC216	CONNECTOR	BNC
W 0007	1	BNC216	CONNECTOR	BNC
W 0008	1	BNC216	CONNECTOR	BNC
W 0009	1	BNC216	CONNECTOR	BNC
W 0010	1	BNC216	CONNECTOR	BNC
W 0011	1	BNC216	CONNECTOR	BNC
W 0012	1	BNC216	CONNECTOR	BNC
W 0016	1	4G471301-1	CABLE 3	P8450A
XF	1	FEU031.1653	FUSE HOLDER	SEV,VDE,SEMKO,UL AND

P8450A ACCESSOR DWG NO 4G208683

REF NO	QTY	PARTS NO	DESCRIPTION	
.	1	3G242286-0	PACKAGING	P8450A
E	1	CM32	CONNECTOR	PWR JACK 3P
F 0001	1	DUH1.6AT	FUSE : UL,DENTORI	1.6A 250V 20MM
MM 0001	1	MJP8450A-0	OP MANUAL	
W 0001	1	1182-1276-2M	CABLE:PWR (DENTORI)	125V 7A

P8450A CABINET DWG NO 4G305773

REF NO	QTY	PARTS NO	DESCRIPTION	
MP	4	LSR17B-CR	FOOT:RUBBER	
MP	1	3G550525-0N	*STAND:FULL	
MP	1	3G550528-0E	*HANDLE,MIDOLE	ASSY
MP	1	3G581094-0C	COVER,TOP	P8450A
MP	1	3G581095-0C	COVER,BTM	P8450A
MP	4	3G670661-0SF	*TRIM	H100XW426
MP	1	3G670680-0SF	*EXTRUSION,RH	D450
MP	1	3G670681-0SF	*EXTRUSION,LH	D450
MP	2	4G550562-0FF	*HOLDER,HANDLE	MIDDLE
MP	4	4G660513-0SF	*FRAME,CORNER	H100
MP	2	4G760754-0G	FOOT,RECT-RH	
MP	2	4G760755-0G	FOOT,RECT LH	
MP	8	4G760756-0G	*RUBBER:FOOT	RECTANGULAR

P8450A MECHA DWG NO 4G305774

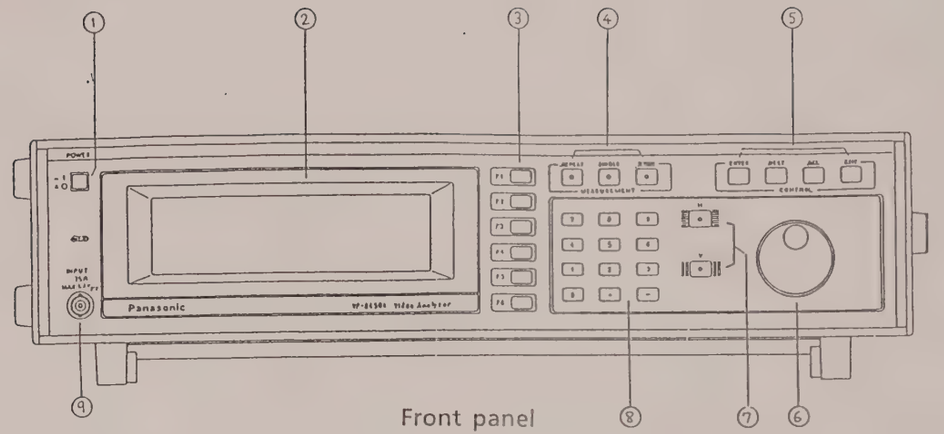
REF NO	QTY	PARTS NO	DESCRIPTION		
.	1	3G111431-2	APPEARANCE	P8450A	
MP	1	R76KTMS-20	BAND HOLDER TMS-20		
MP	1	2G590920-0FB	CHASSIS	P8450A	
MP	1	2G630838-0AH	PANEL	P8450A	
MP	1	3G591090-0BB	PLATE,UPPER	P8450A	
MP	1	3G591091-0BB	PLATE,LOWER	P8450A	
MP	1	3G710402-0N	BAG PACKING	P9551A	
MP	1	3G760595-0S	JOINT:POWER SW		
MP	1	3G760635-0C	*PUSHBUTTON,7X7	GREEN:PWR	
MP	6	3G760649-0C	KEYTOP,IVORY		
MP	3	3G760747-0C	KEYTOP 8X10,IVR	STD MECHA	
MP	1	3G760765-0C	KNOB:JOG	P3684A	VD
MP	1	3G760766-0C	KNOB:SHUTTLE	P3684A	VD
MP	1	3G760767-0W	SPRING:RESIN	P3684A	VD
MP	1	3G760778-0C	KEYTOP 8X10,YLW	STD YELLOW	
MP	5	3G760780-0C	KEYTOP 8X10,G/L	STD GREY W/LED	
MP	1	3G760785-0AA	BEZEL:LCD	P8450A	
MP	1	4G616709-0LB	BAND,D6		
MP	2	4G618805-0CB	PLATE:SP	P8450A	
MP	6	4G644145-2AB	3X15	SPACER	
MP	9	4G644152-3BB	3X5	STUD	
MP	9	4G644546-0BB	STUD 3X10	P7721A	
MP	4	4G644637-0AB	SPACER	P5535A 3-12X0.5MM	
MP	1	4G650530-0NB	NET:FAN	P3683A	
MP	4	4G690791-0EB	COLLAR 4X17.4	P8450A	
MP	1	4G702937-0E	SHAFT:PWR SW	P8450A	
MP	1	4G712047-0N	BAG:PACKING	P9549A	
MP	1	4G712649-0N	BAG:ACCESSORY	PLAIN	
MP	4	4G713005-0W	LABEL-P:100X200	STD	
MP	1	4G760089-0D	BEZEL,7X7-1.5	PUSHBUTTON	
MP	1	4G760760-0CA	KEYTOP,0	P8175A	
MP	1	4G760761-0CA	KEYTOP,1	P8175A	
MP	1	4G760762-0CA	KEYTOP,2	P8175A	
MP	1	4G760763-0CA	KEYTOP,3	P8175A	
MP	1	4G760764-0CA	KEYTOP,4	P8175A	
MP	1	4G760765-0CA	KEYTOP,5	P8175A	
MP	2	4G760766-0CA	KEYTOP,6 & 9	P8175A	
MP	1	4G760767-0CA	KEYTOP,7	P8175A	
MP	1	4G760768-0CA	KEYTOP,8	P8175A	
MP	1	4G760769-0CA	KEYTOP,POINT	P8175A	
MP	1	4G760770-0CA	KEYTOP,-	P8175A	

P8450A MECHA DWG NO 4G305774

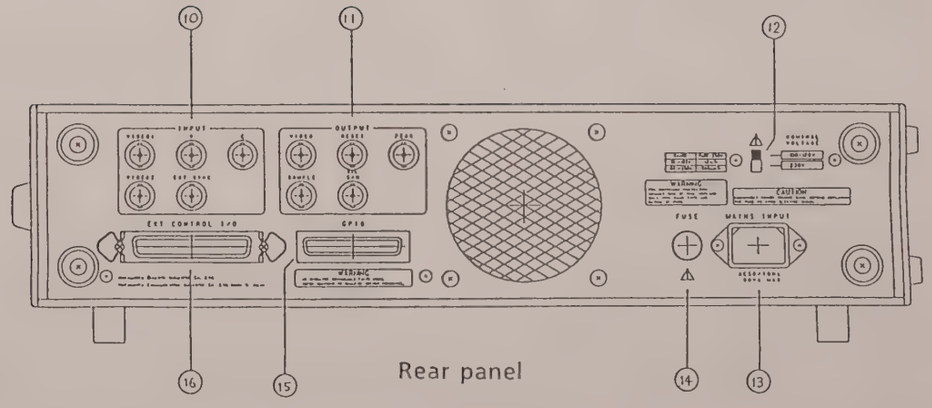
REF NO	QTY	PARTS NO	DESCRIPTION		
MP	1	4G761000-0W	RING:SHUTTLE	P3684A	VD

KP-885 PACKAGE DWG NO 4G305775

REF NO	QTY	PARTS NO	DESCRIPTION	
MP	4	4G712169-0F	CUSHION	KP-840
MP	1	4G713106-0A	CARTON BOX	KP-885
MP	1	885SN0	PACKING KIT	KP885



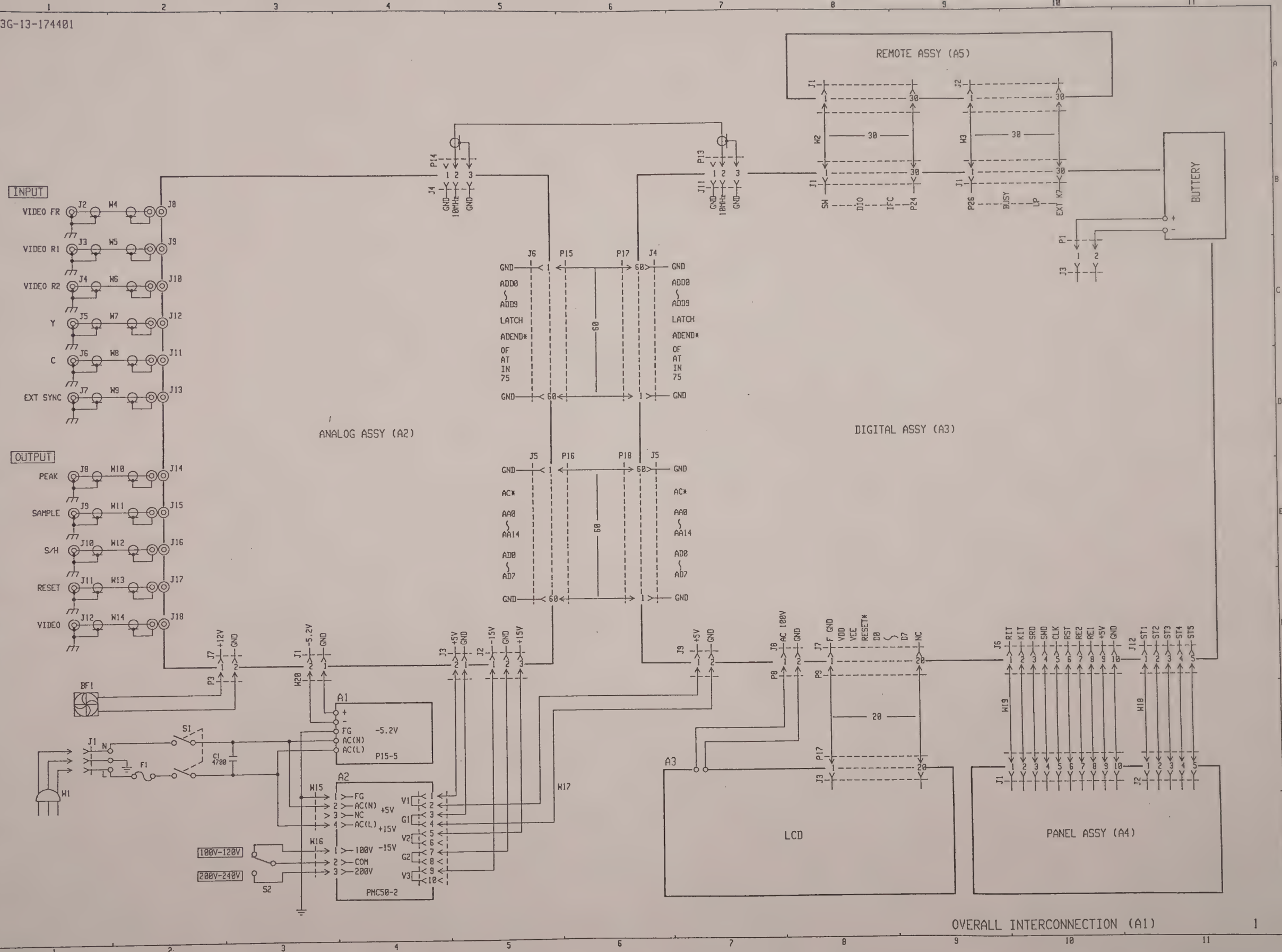
Front panel



Rear panel

3G-13-174401

VP-8450A



OVERALL INTERCONNECTION (A1) 1

SYNC
NNSY
NNBU
fsc
COMPSYNC
HD
NSP
NVD
NCLAMP
PAL.P
NV.P
T.VOL
TP23

NVD
HD
COMPSYNC
V1
V8
ADST
NVCLR
AAA
NDISP
V1
V8
AA0
AA1
NCS1
NCS2
ADST
NARD
NAWR
AD(7:0)
HCLR
STCK
HCLK
N2ND
N1ST
TP1
10MHz
GND
NAC
PAL.P
P.P
ERROR
NERSET
NERROR
NWERSET
NWSY
NWBU
NSCLCK
NN/P
T.VOL
fsc
4fsc
PEAK.H
Y

U38 HC153
U29.1 HC74
U29.2 HC74
U41.1 HC02
U48.1 HC04
U48.2 HC04
U48.3 HC04
U48.4 HC04
U48.5 HC04
U48.6 HC04
U4 UPD71054C
U5 UPD71054C
R242 4.7K
U43.1 HC08
U63.2 F04
U21.2 HC74
U32.2 HC08
U32.4 HC08
U32.1 HC08
U43.2 HC08
C157 0.1
U17 LM1881M
C158 0.1
R283 680K
U42.2 HC112
U42.1 HC112
U45.1 F08
U45.2 F08
U45.3 F08
U45.4 F08
R207 4.7K
R208 4.7K
U46.1 HC10
U46.3 HC10
DL1 65Z14B100
DL2 65Z14B050
C263 20
C159 27
J4 65507-103
U18.3 HC32
U18.4 HC32
R6 4.7K
R270 3.01K 1%
R271 6.98K 1%
R272 2.0K 1%
R273 10K
C188 0.1
U130.2 UPC393C
U130.1 UPC393C
U59 F163
U58.3 HC08
U9.3 HC10
U9.1 HC10
U8.2 HC74
U8.1 HC74
R284 100K
R285 100K
C194 1000
C195 1000
R286 1M
R288 1M
U61.1 HC04
U61.2 HC04
U72.1 HC04
U72.2 HC04
Y1 17.734475MHz
Y2 14.31818MHz
R287 330
R289 470
C196 12
C197 18
C264 18
C265 18
CR23 1SV101
CR24 1SV101
U70.4 HC00
U70.3 HC00
U71.2 HC00
U68.3 HC04
U72.3 HC04
U72.4 HC04
U61.3 HC04
U61.4 HC04
U68.1 HC04
U68.2 HC04
U68.4 HC04
U72.5 HC04
U72.6 HC04
U61.5 HC04
U61.6 HC04
U68.5 HC04
U68.6 HC04
U71.1 HC00
U71.3 HC00
U71.4 HC00
U41.3 HC02
U9.2 HC10
U10.2 HC32
U46.2 HC10
U58.1 HC08
U58.2 HC08
U70.2 HC08
U70.1 HC08

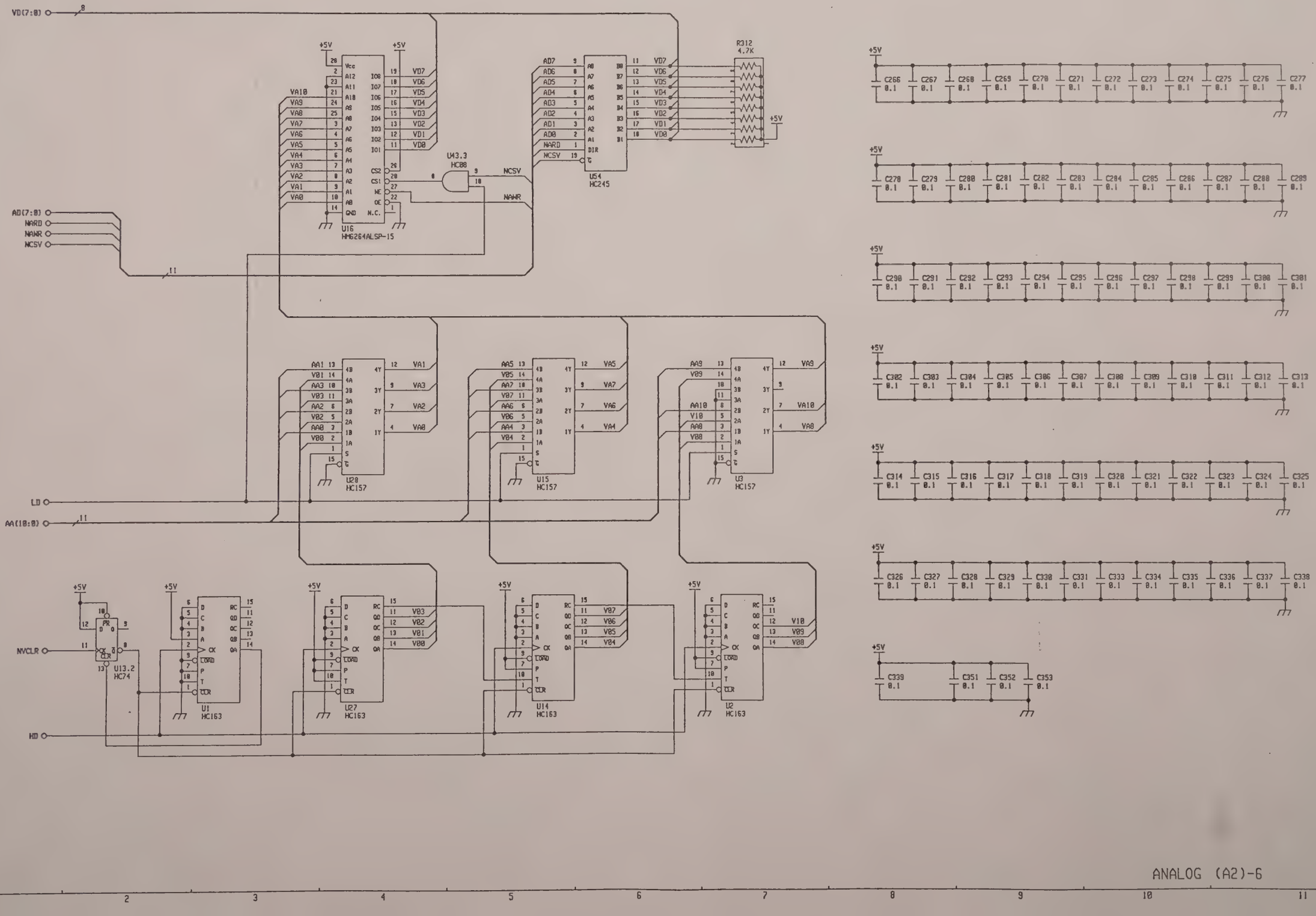
ANALOG (A2)-4

NRESET
S/H
PEAK.H
fsc
4fsc
STCK
Y
CC
BB
AA
AAA
NVCLR
HCLK
HCLR
NAHR
NCSH
LD
ADST
NAC
ADCLK
LATCH(3:8),NADEND
NADEND
LATCH3
LATCH2
LATCH1
LATCH0
SAMPLE OUT
VD(7:8)
AD(7:8)
AA(10:8)

R281 3K
C155 22
R282 18K
C156 100
U57.2 HC123
U57.1 HC123
U69 HC157
U41.2 HC02
U67.1 F112
U68.2 F74
U68.1 F74
U67.2 F112
U65 F163
U63.1 F04
U64 F163
U66.1 F08
U63.6 F04
R241 4.7K
U63.5 F04
U62 F164
R200 7.5K
C154 47
U52.2 HC123
J15
U63.3 F04
U39 HC157
R243 4.7K
U56 HC574
R284 4.7K
R285 4.7K
R286 4.7K
U18 HM62832H
U55 HC245
R311 4.7K
R4 4.7K
U66.3 F08
U66.2 F08
U63.4 F04
U52.1 HC123
U13.1 HC74
U66.4 F08
U43.4 HC08
U21.1 HC74
U32.3 HC08
U30 HC157
U19 HC157
U6 HC157
U44 HC157
R209 4.7K
U31 HC161
U20 HC161
U7 HC161

337226002LCSC

NAC
NMSY
NMBU
NSCLCK
ADST
LD
VB
V1
Y
NV/P
NERSET
NMERSET
ERROR
NERROR
LCDVE
NCSV
NCSH
NCS1
NCS2
NARD
NAWR
AA0
AA1
AA2
AA3
AA4
AA5
AA6
AA7
AA8
AA9
AA10
AA11
AA12
AA13
AA14
NCSL
AD0
AD1
AD2
AD3
AD4
AD5
AD6
AD7
NSP
COMPSYNC
NVD
N2ND
N1ST
NDISP
NMARK


VD(7:0)
AD(7:0)
NARD
NAWR
NCSV
LD
AA(10:0)
NVCLR
WD
+5V
U16
HM6264ALSP-15
U43.3
HC08
U54
HC245
R312
4.7K
U20
HC157
U15
HC157
U3
HC157
U13.2
HC74
U1
HC163
U27
HC163
U14
HC163
U2
HC163
C266 C267 C268 C269 C270 C271 C272 C273 C274 C275 C276 C277
C278 C279 C280 C281 C282 C283 C284 C285 C286 C287 C288 C289
C290 C291 C292 C293 C294 C295 C296 C297 C298 C299 C300 C301
C302 C303 C304 C305 C306 C307 C308 C309 C310 C311 C312 C313
C314 C315 C316 C317 C318 C319 C320 C321 C322 C323 C324 C325
C326 C327 C328 C329 C330 C331 C333 C334 C335 C336 C337 C338
C339 C351 C352 C353
0.1

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DB(7:0)
DB(15:8)
AB(7:1)
AB(15:8)
AB(23:16)

CLOCK

U51 MC68881

U50 HD68000-12

U34.2 HC08

U68 PAL16L8

U72 PAL16L8

U36 PAL16L8

U4 UPD27C1824

U3 UPD27C1824

U34.1 HC08

U73.4 HC04

U73.3 HC04

U113 MB3771

U112.1 HC00

U112.2 HC00

U112.4 HC00

U112.3 HC00

U73.5 HC04

U74.5 LS86

U74.4 LS86

U35.2 HC00

U61 HC30

U62 HC164

U74.1 LS86

U76.1 LS04

U76.2 LS04

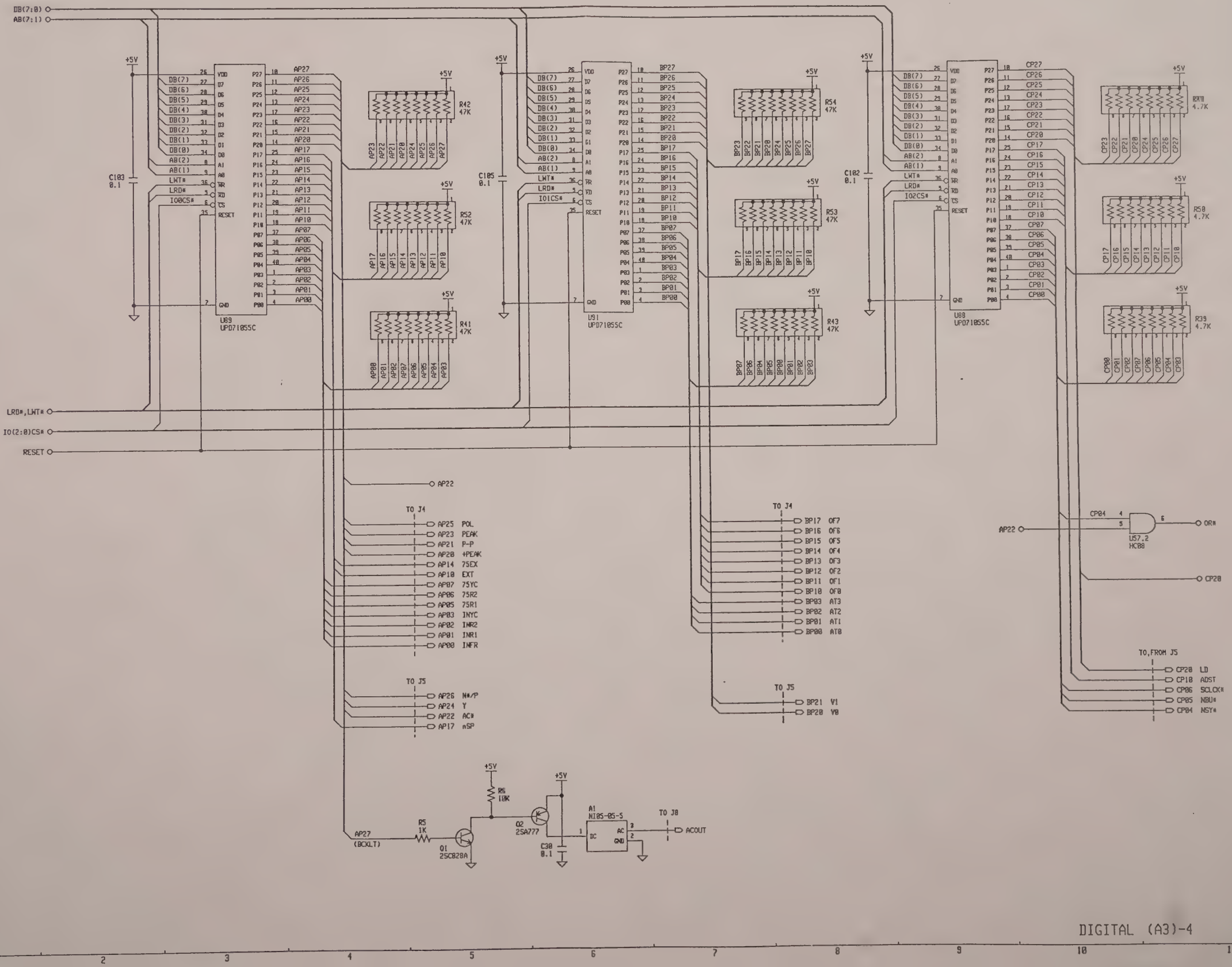
Y1 EXO-3C (24M)

CPRCS#

CLOCK

DB(15:8)
DB(7:0)
AB(16)
AB(15:0)
AB(7:1)
ADDCS#
VBAK
+5V
C32 0.1
C31 0.1
C17 0.1
C16 0.1
C15 0.1
C49 0.1
C48 0.1
U21 UPD43256C
U20 UPD43256C
U7 UPD43256C
U6 UPD43256C
U5 UPD27C1024
ROM2#
U23 HC138
IOCS#
PANCS#
EXTCS#
TIM2CS#
TIM1CS#
INT2CS#
INT1CS#
GPIBCS#
U22 HC138
LCDCS#
IO3CS#
IO2CS#
IO1CS#
IO0CS#
TIMBCS#
TIMACS#
U39 UPD71054C
U38 UPD71054C
TM4INT
TM3INT
TM2INT
TM1INT
TM(4:1)INT
RAM0CS#
RAM1CS#
ROMRD#
ROM2#,IOCS#
URD#,UWT#,IACK4#
LRD#,LWT#
PANCS#,EXTCS#,INT(2:1)CS#,GPIBCS#
IO(2:0)CS#
LCDCS#,IO3CS#,TIM(A,B)CS#
CLX12M
R28 100
R26 100
R27 100
R30 100
U75.1 LS393
IACK4#
U48.4 HC04
U74.6 LS86
U48.3 HC04
U34.3 HC08
U52.2 HC02
U63 HC164
INTACK#
CLX6M
DTACK#

DB(7:0)
AB(7:1)
TM(4:1)INT
LRD#,LWT#
PANCS#,EXTCS#,INT(2:1)CS#,GPIBCS#
INTACK#
RESET#
CLK6M
SMPEND
GPIBINT
(EXTINT)
IPL2#
NERROR
ERROR
FROM J5
TO,FROM J2
TO,FROM J12
FROM J12
FROM J1
TO J1
U25 UPD71059C
U24 UPD71059C
U87 UPD71855C
U38 UPD7210C
U115 LS148
U114 LS541
U117 SN75160
U118 SN75161A
U73.1 HC04
U73.2 HC04
U48.5 HC04
U35.1 HC08
U1.3 HC32
U1.2 HC32
U2 HC574
U116 HC541
R85 47K
R84 47K
R49 47K
R37 4.7K
R35 47K
R34 47K
R38 47K
R33 47K
R51 47K
C36 0.1
C35 0.1
C101 0.1
C104 0.1


DB(7:0)
AB(7:1)
LRD*,LWT*
IO(2:0)CS*
RESET
+5V
U89
UPD71055C
U91
UPD71055C
U88
UPD71055C
C103 0.1
C105 0.1
C102 0.1
R42 47K
R52 47K
R41 47K
R54 47K
R53 47K
R43 47K
R50 4.7K
R39 4.7K
AP22
TO J4
AP25 POL
AP23 PEAK
AP21 P-P
AP20 +PEAK
AP14 75EX
AP10 EXT
AP07 75YC
AP06 75R2
AP05 75R1
AP03 INYC
AP02 INR2
AP01 INR1
AP00 INFR
TO J5
AP26 N*/P
AP24 Y
AP22 AC*
AP17 nSP
BP17 OF7
BP16 OF6
BP15 OF5
BP14 OF4
BP13 OF3
BP12 OF2
BP11 OF1
BP10 OF0
BP03 AT3
BP02 AT2
BP01 AT1
BP00 AT0
BP21 V1
BP20 V0
CP04
U57.2
HC08
OR*
CP20
TO,FROM J5
CP20 LD
CP10 ADST
CP06 SCLOK*
CP05 NBU*
CP04 NSY*
AP27
(BCKLT)
R5 1K
Q1 2SC828A
R6 10K
Q2 2SA777
C30 0.1
A1 NI05-05-5
TO J8
ACOUT

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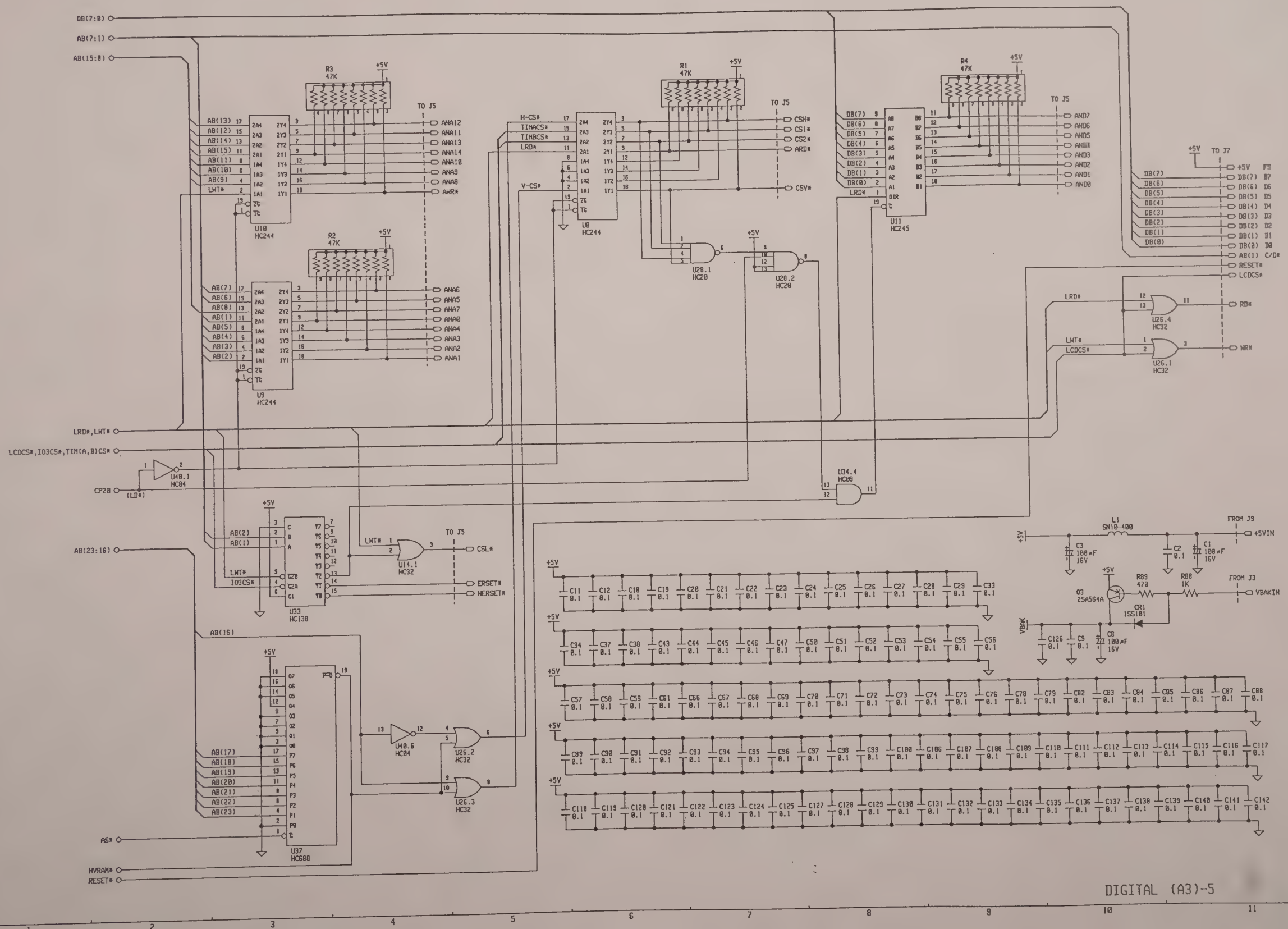
DB(7:0)
AB(7:1)
AB(15:8)
R3 47K
+5V
TO J5
AB(13) AB(12) AB(14) AB(15) AB(11) AB(10) AB(9) LWT#
ANA12 ANA11 ANA13 ANA14 ANA10 ANA9 ANA8 AHR#
U10 HC244
R2 47K
AB(7) AB(6) AB(8) AB(1) AB(5) AB(4) AB(3) AB(2)
ANA6 ANA5 ANA7 ANA0 ANA4 ANA3 ANA2 ANA1
U9 HC244
H-CS# TIMACS# TIMBCS# LRD#
V-CS#
R1 47K
CSH# CS1# CS2# ARD# CSV#
U8 HC244
U28.1 HC20
U28.2 HC20
R4 47K
DB(7) DB(6) DB(5) DB(4) DB(3) DB(2) DB(1) DB(0) LRD#
AND7 AND6 AND5 AND4 AND3 AND2 AND1 AND0
U11 HC245
TO J7
+5V FS
DB(7) D7
DB(6) D6
DB(5) D5
DB(4) D4
DB(3) D3
DB(2) D2
DB(1) D1
DB(0) D0
AB(1) C/D#
RESET#
LCDCS#
LRD#
RD#
U26.4 HC32
LWT#
LCDCS#
WR#
U26.1 HC32
LRD#,LWT#
LCDCS#,IO3CS#,TIM(A,B)CS#
CP20
(LD#)
U40.1 HC04
U34.4 HC08
AB(23:16)
AB(2)
AB(1)
LWT#
IO3CS#
U33 HC138
LWT#
U14.1 HC32
CSL#
ERSET#
NERSET#
AB(16)
AB(17) AB(18) AB(19) AB(20) AB(21) AB(22) AB(23)
U37 HC688
U40.6 HC04
U26.2 HC32
U26.3 HC32
AS#
HVRAM#
RESET#
L1 SN10-400
FROM J9
+5VIN
C3 100uF 16V
C2 0.1
C1 100uF 16V
Q3 2SA564A
R89 470
R88 1K
FROM J3
VBAKIN
CR1 1SS101
C126 0.1
C9 0.1
C8 100uF 16V
C11 C12 C18 C19 C20 C21 C22 C23 C24 C25 C26 C27 C28 C29 C33 0.1
C34 C37 C38 C43 C44 C45 C46 C47 C50 C51 C52 C53 C54 C55 C56 0.1
C57 C58 C59 C61 C66 C67 C68 C69 C70 C71 C72 C73 C74 C75 C76 C78 C79 C82 C83 C84 C85 C86 C87 C88 0.1
C89 C90 C91 C92 C93 C94 C95 C96 C97 C98 C99 C100 C106 C107 C108 C109 C110 C111 C112 C113 C114 C115 C116 C117 0.1
C118 C119 C120 C121 C122 C123 C124 C125 C127 C128 C129 C130 C131 C132 C133 C134 C135 C136 C137 C138 C139 C140 C141 C142 0.1

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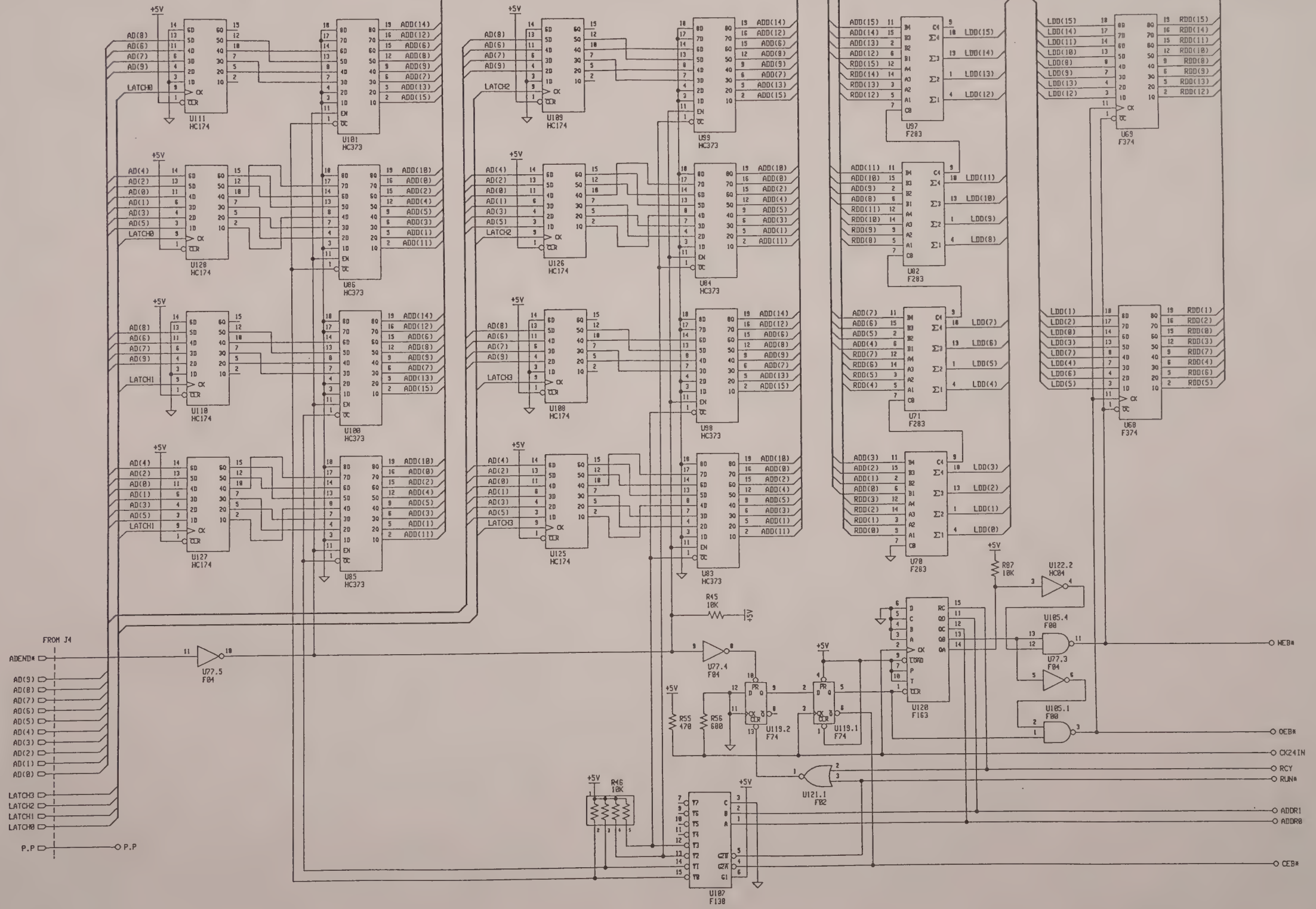
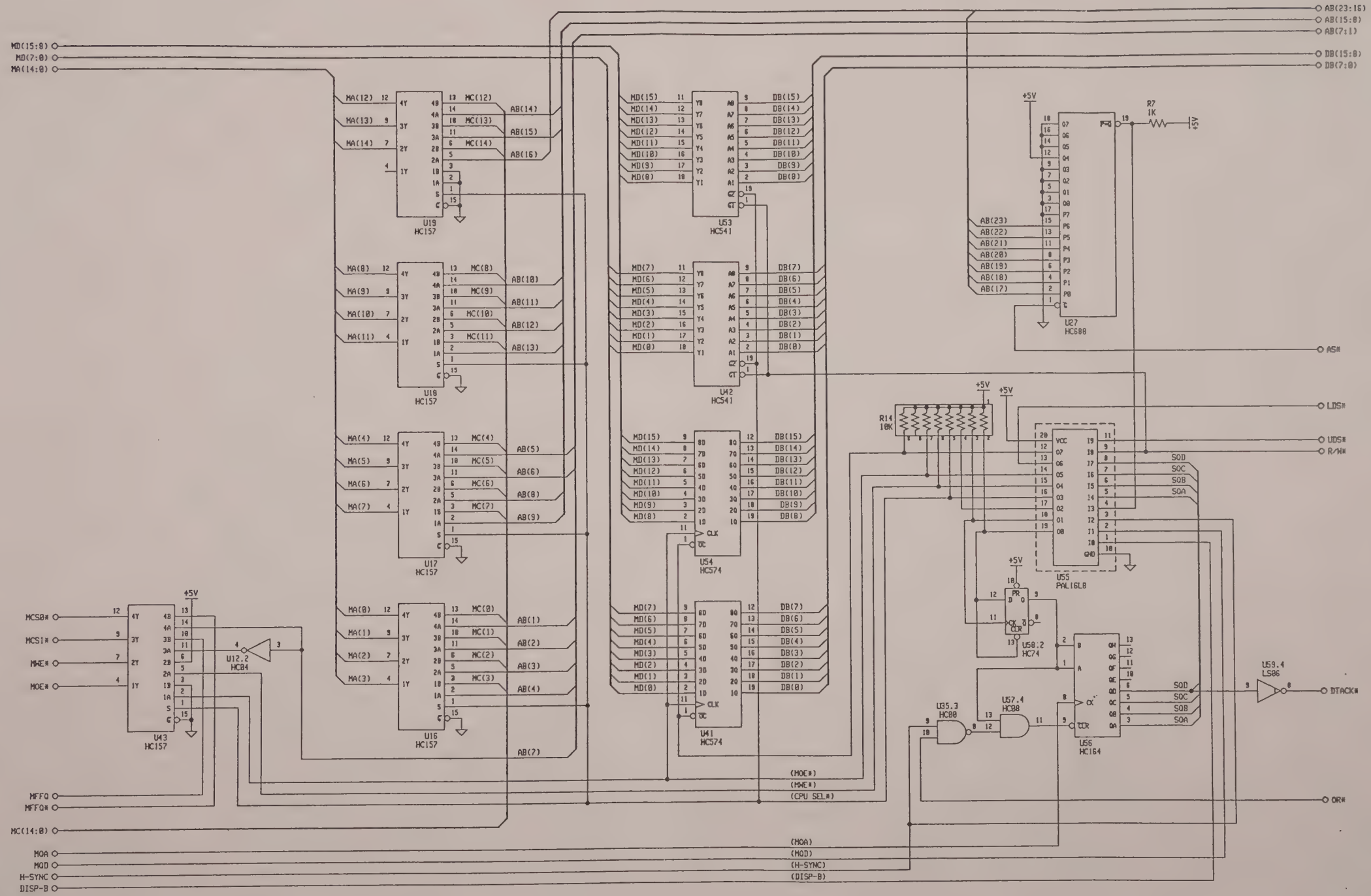

+5V
AD(8)
AD(6)
AD(7)
AD(9)
LATCH0
U111 HC174
U101 HC373
ADD(14)
ADD(12)
ADD(6)
ADD(8)
ADD(9)
ADD(7)
ADD(13)
ADD(15)
AD(4)
AD(2)
AD(0)
AD(1)
AD(3)
AD(5)
LATCH0
U128 HC174
U86 HC373
ADD(10)
ADD(0)
ADD(2)
ADD(4)
ADD(5)
ADD(3)
ADD(1)
ADD(11)
LATCH1
U110 HC174
U100 HC373
LATCH1
U127 HC174
U85 HC373
LATCH2
U109 HC174
U99 HC373
U126 HC174
U84 HC373
LATCH3
U108 HC174
U98 HC373
U125 HC174
U83 HC373
RDD(15:0)
U97 F283
U82 F283
U71 F283
U70 F283
LDD(15)
LDD(14)
LDD(13)
LDD(12)
LDD(11)
LDD(10)
LDD(9)
LDD(8)
LDD(7)
LDD(6)
LDD(5)
LDD(4)
LDD(3)
LDD(2)
LDD(1)
LDD(0)
U69 F374
U68 F374
RDD(15)
RDD(14)
RDD(11)
RDD(10)
RDD(8)
RDD(9)
RDD(13)
RDD(12)
RDD(7)
RDD(6)
RDD(5)
RDD(4)
RDD(3)
RDD(2)
RDD(1)
RDD(0)
R87 10K
U122.2 HC04
R45 10K
U77.4 F04
U77.5 F04
FROM J4
ADEND*
P.P
U120 F163
U105.4 F08
U77.3 F04
U105.1 F08
WEB*
OEB*
CK24IN
RCY
RUN*
ADDR1
ADDR0
CEB*
R55 470
R56 680
U119.2 F74
U119.1 F74
R46 10K
U121.1 F02
U107 F138


MD(15:8)
MD(7:0)
MA(14:0)
AB(23:16)
AB(15:8)
AB(7:1)
DB(15:8)
DB(7:0)
U19 HC157
U18 HC157
U17 HC157
U16 HC157
U43 HC157
U12.2 HC04
U53 HC541
U42 HC541
U54 HC574
U41 HC574
U27 HC688
R7 1K
R14 10K
U55 PAL16L8
U58:2 HC74
U57.4 HC08
U35.3 HC00
U56 HC164
U59.4 LS06
AS#
LDS#
UDS#
R/W#
DTACK#
OR#
MCS0#
MCS1#
MWE#
MOE#
MFFQ
MFFQ#
MC(14:0)
MOA
MOD
H-SYNC
DISP-B
(MOE#)
(MWE#)
(CPU SEL#)
(MOA)
(MOD)
(H-SYNC)
(DISP-B)
SOD
SOC
SOB
SOA
+5V

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MD(15:0)
MD(7:0)
MA(14:0)

TO J5
MARK#
U12.4 HC04
+5V
U57.3 HC08
U58.1 HC74
U46 HC166
U45 HC166
U31 UPD43256C
U32 UPD43256C
U29 UPD43256C
U30 UPD43256C
C41 0.1
C42 0.1
C39 0.1
C40 0.1
MCS0#
MCS1#
MWE#
MOE#
MC(14:0)
U12.1 HC04
U14.2 HC32
U57.1 HC08
U14.3 HC32
U47 HC161
R11 10K
FROM J10
10MHz
FROM J5
DISP#
VD#
COMPSY#
1ST#
2ND#
U49.1 HC04
U48.2 HC74
U48.1 HC74
U49.2 HC04
U13.1 HC393
U13.2 HC393
U44.1 HC74
U15.1 HC393
U15.2 HC393
MC(6)
U12.5 HC04
U12.3 HC04
U12.6 HC04
U49.4 HC04
U49.3 HC04
U49.6 HC04
U49.5 HC04
U35.4 HC08
U44.2 HC74
MOD
MOA
H-SYNC
DISP-B
OR#
MFFQ
MFFQ#

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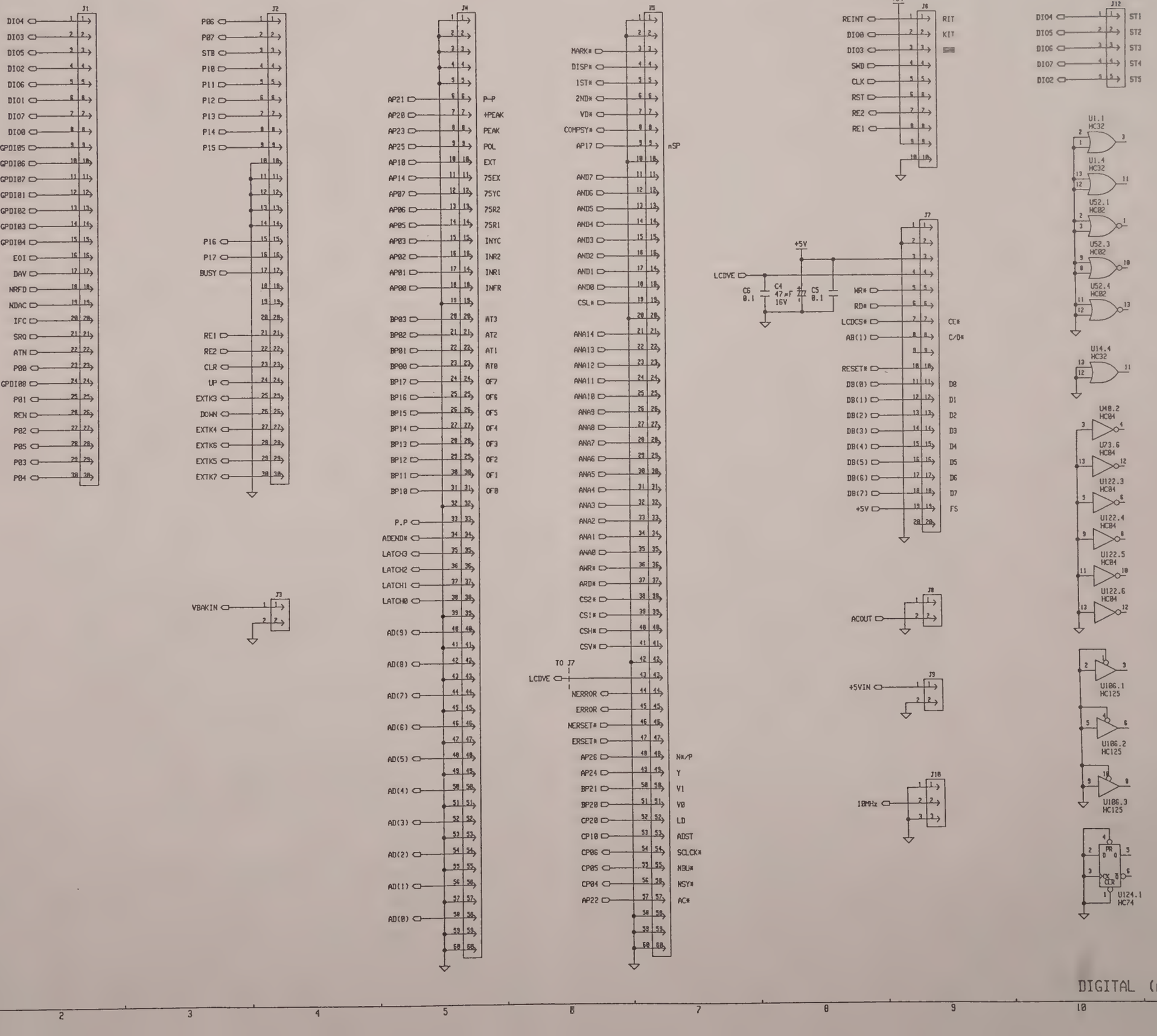
J1
DIO4
DIO3
DIO5
DIO2
DIO6
DIO1
DIO7
DIO0
GPDI05
GPDI06
GPDI07
GPDI01
GPDI02
GPDI03
GPDI04
EOI
DAV
NRFD
NDAC
IFC
SRQ
ATN
P00
GPDI08
P01
REN
P02
P05
P03
P04
J2
P06
P07
STB
P10
P11
P12
P13
P14
P15
P16
P17
BUSY
RE1
RE2
CLR
UP
EXTK3
DOWN
EXTK4
EXTK6
EXTK5
EXTK7
J3
VBAKIN
J4
AP21
AP20
AP23
AP25
AP10
AP14
AP07
AP06
AP05
AP03
AP02
AP01
AP00
BP03
BP02
BP01
BP00
BP17
BP16
BP15
BP14
BP13
BP12
BP11
BP10
P.P
ADEND#
LATCH3
LATCH2
LATCH1
LATCH0
AD(9)
AD(8)
AD(7)
AD(6)
AD(5)
AD(4)
AD(3)
AD(2)
AD(1)
AD(0)
P-P
+PEAK
PEAK
POL
EXT
75EX
75YC
75R2
75R1
INYC
INR2
INR1
INFR
AT3
AT2
AT1
AT0
OF7
OF6
OF5
OF4
OF3
OF2
OF1
OF0
J5
MARK#
DISP#
1ST#
2ND#
VD#
COMPSY#
AP17
nSP
AND7
AND6
AND5
AND4
AND3
AND2
AND1
AND0
CSL#
ANA14
ANA13
ANA12
ANA11
ANA10
ANA9
ANA8
ANA7
ANA6
ANA5
ANA4
ANA3
ANA2
ANA1
ANA0
AWR#
ARD#
CS2#
CS1#
CSH#
CSV#
TO J7
LCDVE
NERROR
ERROR
NERSET#
ERSET#
AP26
AP24
BP21
BP20
CP20
CP10
CP06
CP05
CP04
AP22
N#/P
Y
V1
V0
LD
ADST
SCLCK#
NBU#
NSY#
AC#
+5V
J6
REINT
DIO0
DIO3
SWD
CLK
RST
RE2
RE1
RIT
KIT
J7
LCDVE
C6
0.1
C4
47μF
16V
C5
0.1
WR#
RD#
LCDCS#
AB(1)
RESET#
DB(0)
DB(1)
DB(2)
DB(3)
DB(4)
DB(5)
DB(6)
DB(7)
+5V
CE#
C/D#
D0
D1
D2
D3
D4
D5
D6
D7
FS
J8
ACOUT
J9
+5VIN
J10
10MHz
J12
DIO4
DIO5
DIO6
DIO7
DIO2
ST1
ST2
ST3
ST4
ST5
U1.1
HC32
U1.4
HC32
U52.1
HC02
U52.3
HC02
U52.4
HC02
U14.4
HC32
U40.2
HC04
U73.6
HC04
U122.3
HC04
U122.4
HC04
U122.5
HC04
U122.6
HC04
U106.1
HC125
U106.2
HC125
U106.3
HC125
U124.1
HC74
PR
D
Q
CK
CLR

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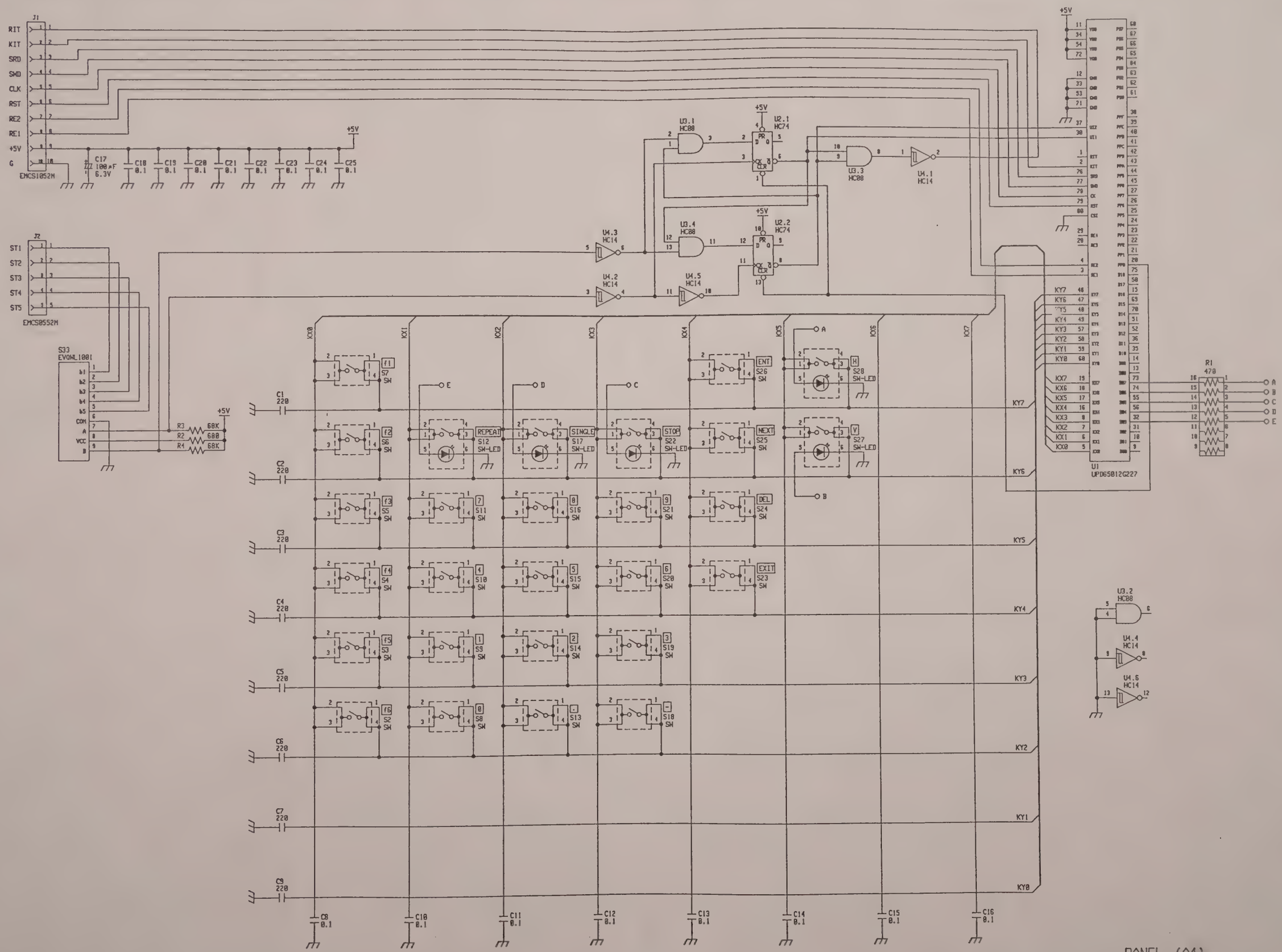
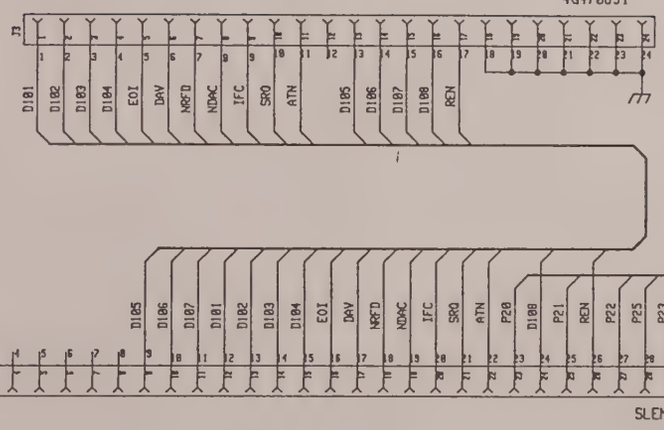

J1
RIT
KIT
SRO
SWO
CLK
RST
RE2
RE1
+5V
G
EMCS1052M
C17 100μF 6.3V
C18 0.1
C19 0.1
C20 0.1
C21 0.1
C22 0.1
C23 0.1
C24 0.1
C25 0.1
J2
ST1
ST2
ST3
ST4
ST5
EMCS0552M
S33
EVQWL1001
R3 68K
R2 680
R1 68K
U3.1 HC08
U2.1 HC74
U3.3 HC08
U4.1 HC14
U4.3 HC14
U3.4 HC08
U2.2 HC74
U4.2 HC14
U4.5 HC14
U1
UPD65012G227
R1 470
KX0
KX1
KX2
KX3
KX4
KX5
KX6
KX7
KY7
KY6
KY5
KY4
KY3
KY2
KY1
KY0
C1 220
C2 220
C3 220
C4 220
C5 220
C6 220
C7 220
C8 0.1
C9 220
C10 0.1
C11 0.1
C12 0.1
C13 0.1
C14 0.1
C15 0.1
C16 0.1
f1 S7 SW
f2 S6 SW
f3 S5 SW
f4 S4 SW
f5 S3 SW
f6 S2 SW
7 S11 SW
8 S16 SW
9 S21 SW
DEL S24 SW
4 S10 SW
5 S15 SW
6 S20 SW
EXIT S23 SW
1 S9 SW
2 S14 SW
3 S19 SW
0 S8 SW
. S13 SW
- S18 SW
ENT S26 SW
H S28 SW-LED
REPEAT S12 SW-LED
SINGLE S17 SW-LED
STOP S22 SW-LED
NEXT S25 SW
V S27 SW-LED
A
B
C
D
E
U3.2 HC08
U4.4 HC14
U4.6 HC14

VP-8450A

VP-8450A

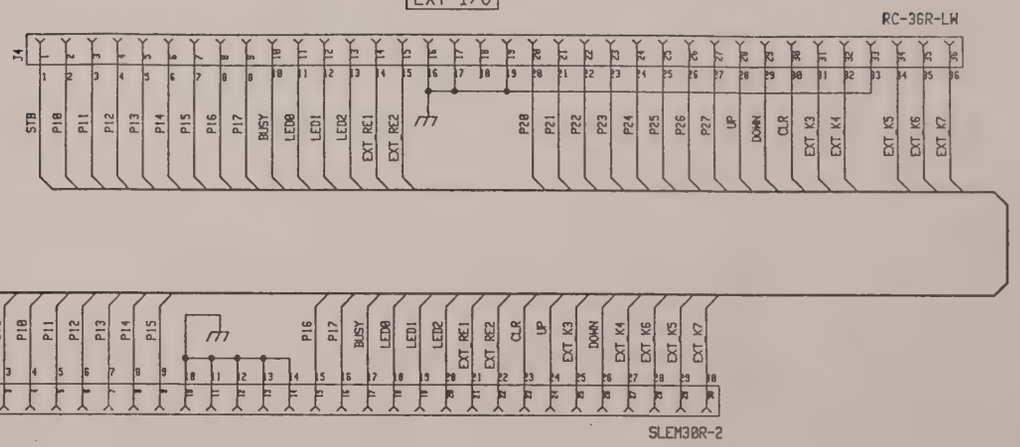
GP-IB

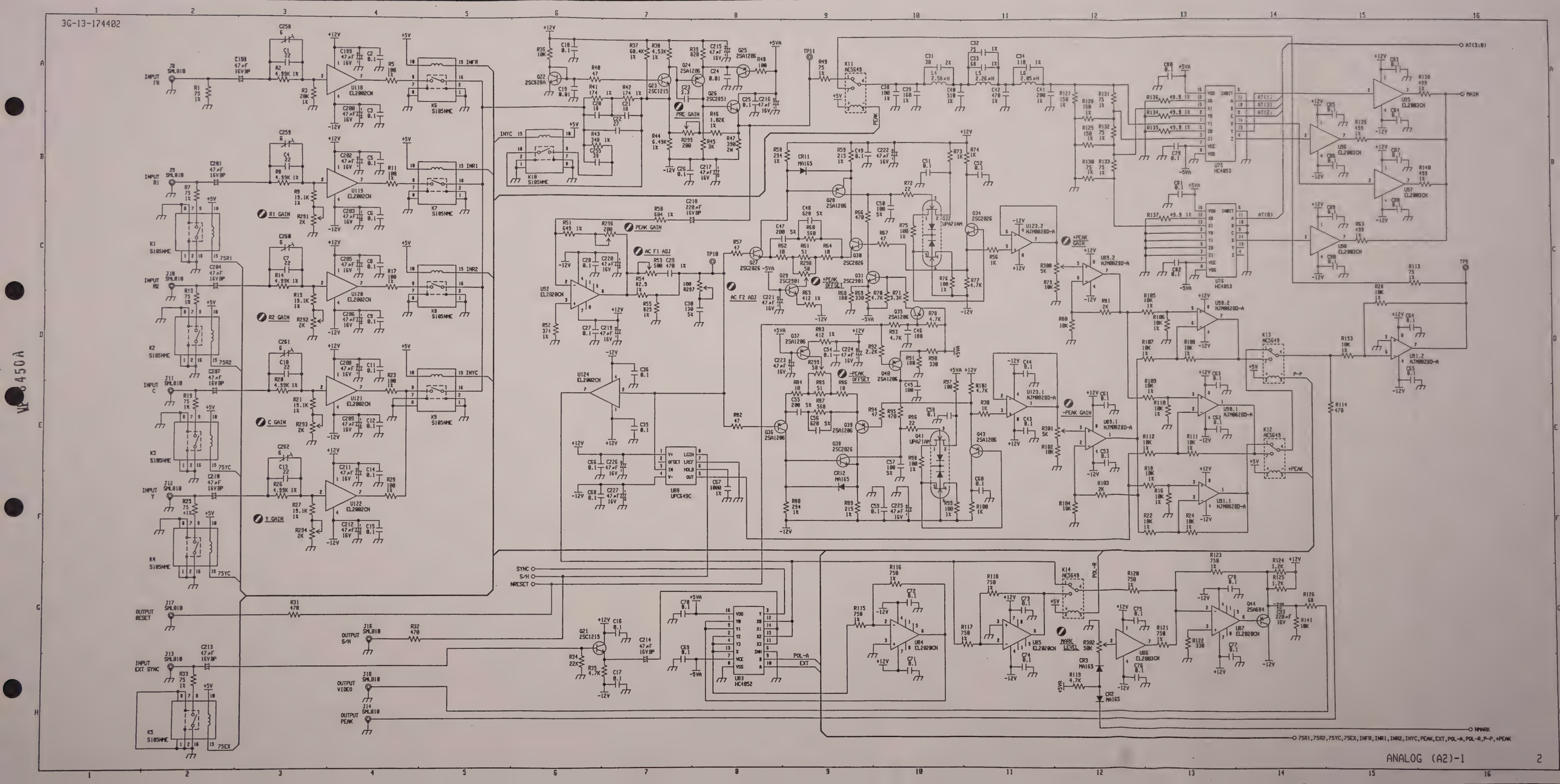
4G470851

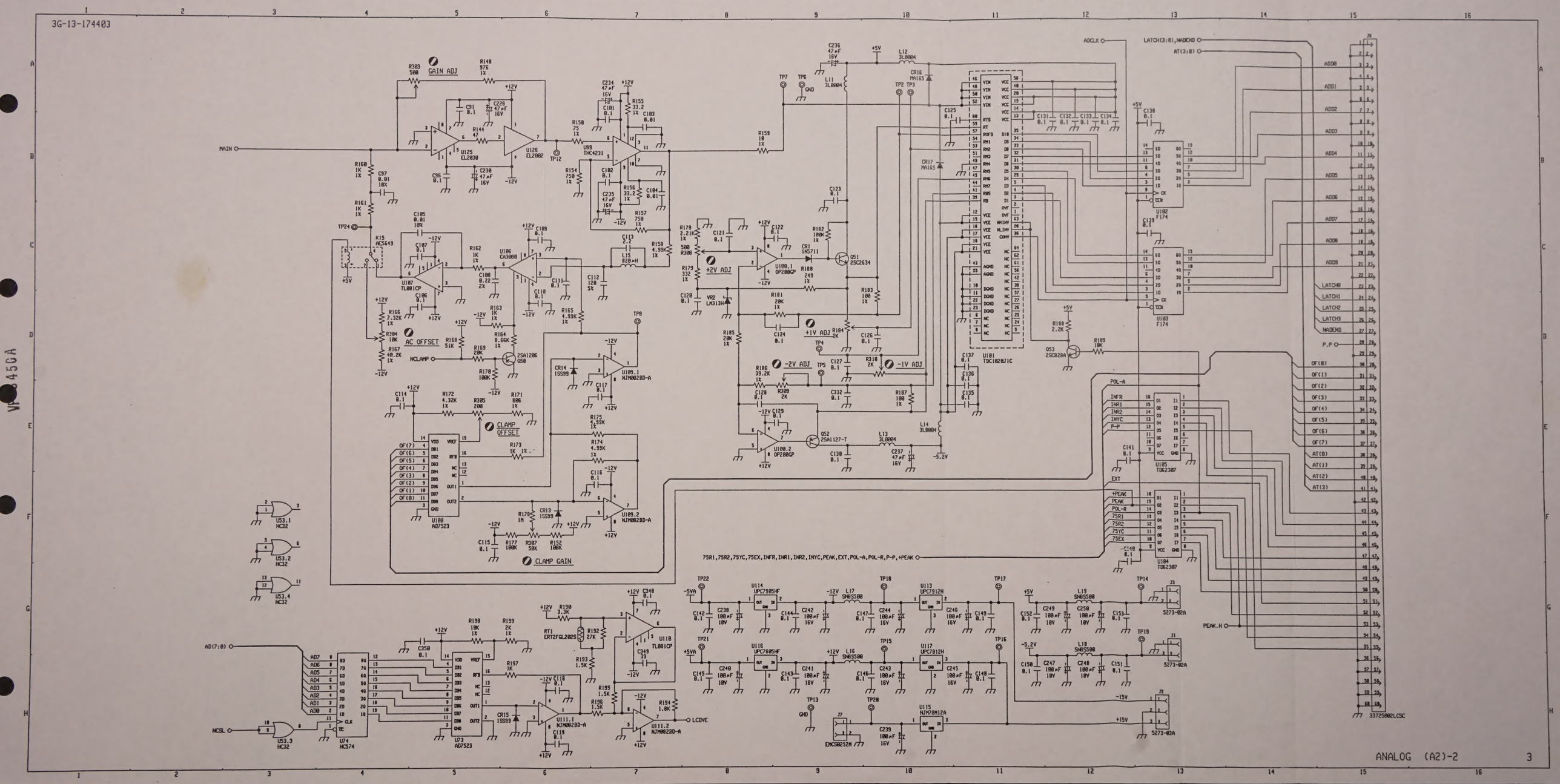


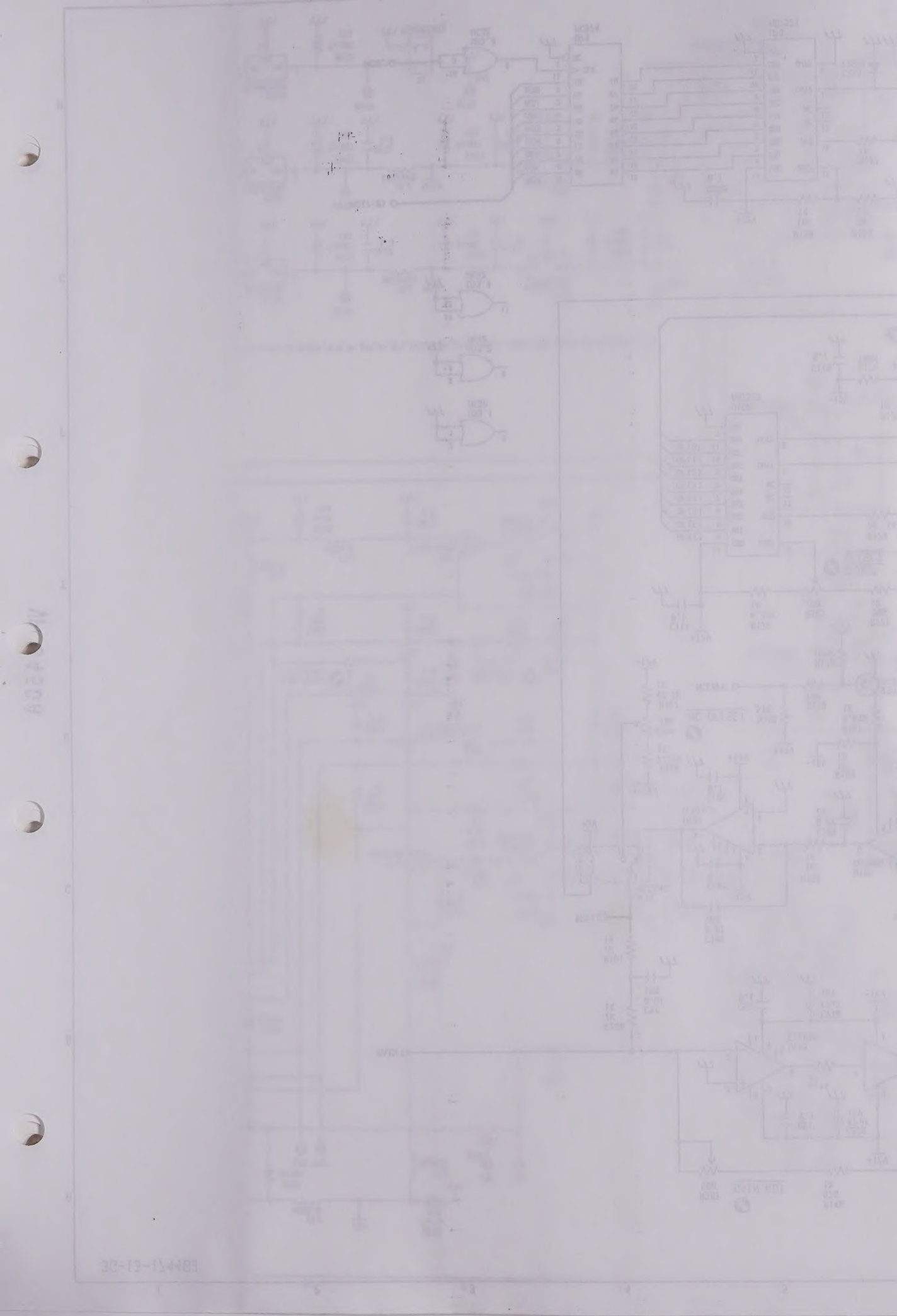
EXT I/O

RC-36R-LW




3G-13-174402
INPUT FR
INPUT R1
INPUT R2
INPUT C
INPUT Y
INPUT EXT SYNC
R1 GAIN
R2 GAIN
C GAIN
Y GAIN
AC F1 ADJ
AC F2 ADJ
PEAK GAIN
PEAK OFFSET
-PEAK OFFSET
+PEAK GAIN
-PEAK GAIN
MARK LEVEL
PRE GAIN
INYC
SYNC
S/H
NRESET
OUTPUT RESET
OUTPUT S/H
OUTPUT VIDEO
OUTPUT PEAK
POL-A EXT
AT(3:0)
MAIN
P-P
+PEAK
NMARK
75R1,75R2,75YC,75EX,INFR,INR1,INR2,INYC,PEAK,EXT,POL-A,POL-R,P-P,+PEAK
ANALOG (A2)-1
2


GAIN ADJ
AC OFFSET
CLAMP OFFSET
CLAMP GAIN
+2V ADJ
+1V ADJ
-2V ADJ
-1V ADJ
MAIN
NCLAMP
ADCLK
LATCH(3:0),NADEN0
AT(3:0)
POL-A
EXT
75R1,75R2,75YC,75EX,INFR,INR1,INR2,INYC,PEAK,EXT,POL-A,POL-R,P-P,+PEAK
PEAK.H
AD(7:0)
NCSL
LCDVE
ANALOG (A2)-2
3



MP MASTER
MA32237